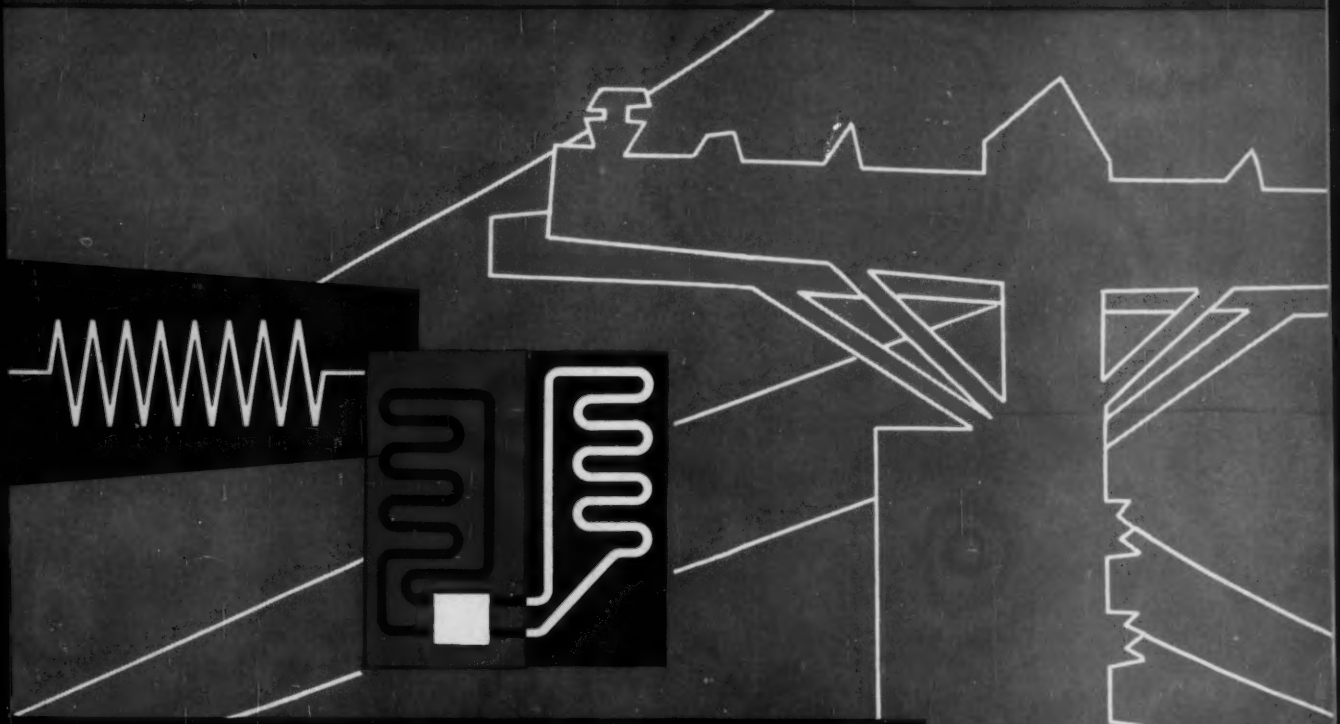
The Electrical Industry's Weekly Magazine

June 9, 1958

Electrical World

Price 50 Cents

A McGraw-Hill Publication



High-Use Homes:

What Distribution

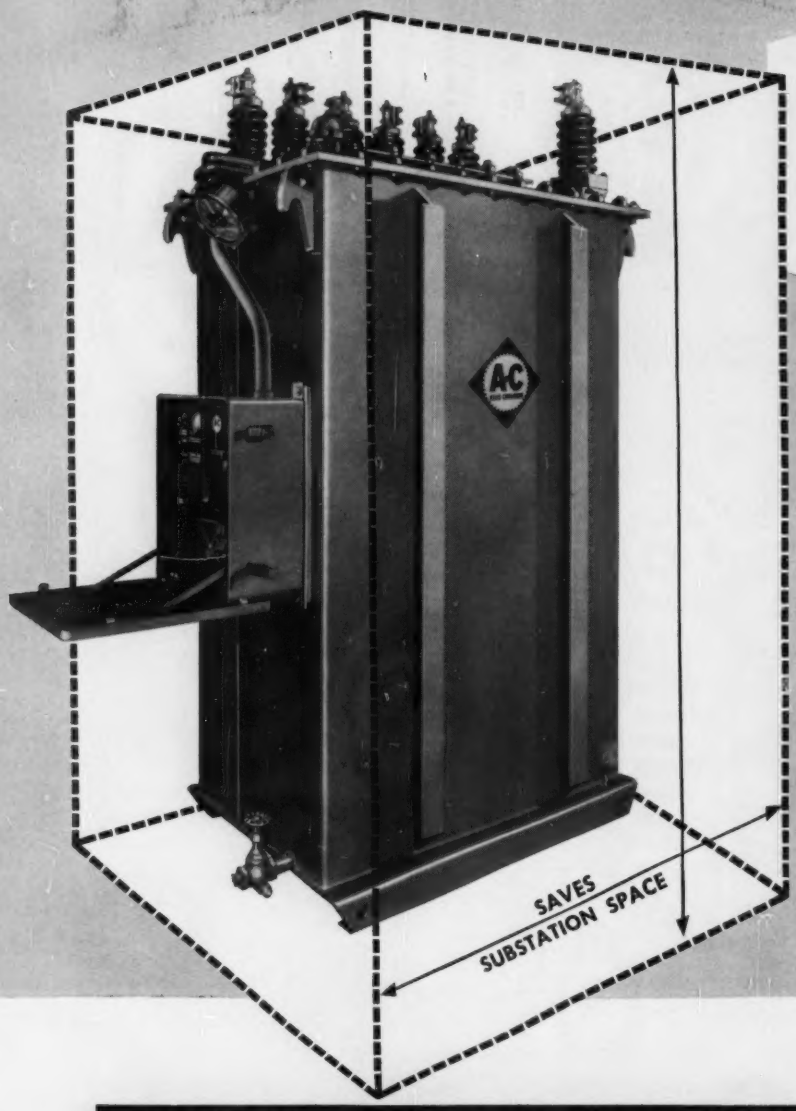
Will They Need?

A SPECIAL REPORT: PAGE 61

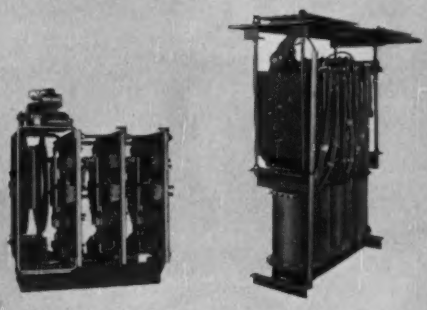
$5 Million EHV Research Charted . . . p

E B POWER GS W
UNIVERSITY MICROFILMS I
313 N 1 ST
ANN ARBOR MICH

Allis-Chalmers—25 years of leadership in 5/8% regulators



NOW save 33% space... 30% cost



Illustrations show heavy-duty tap-changing mechanism and unit construction combined with new space-saving arrangement of tap-changing mechanism.

NEW Allis-Chalmers 3-phase distribution regulators

Get these new benefits only with Allis-Chalmers new 3-phase distribution regulators:

- 33% less space required for distribution regulators in substation.
- 20% less weight for easier handling, lower installation costs than ever before.
- 30% less cost per kva of 3-phase regulation.
- 160% *Vari-Amp* rating is now provided to 600 ampere maximum.

Available in most popular ratings as follows: 500 and 750 kva, 8660 v; and 500, 750 and 1000 kva, 13,200 v.

The important savings offered by these new units warrant re-evaluation of your present substation planning.

Check with your nearby A-C office or contact Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

Originators of 5/8% Step Regulators

ALLIS-CHALMERS

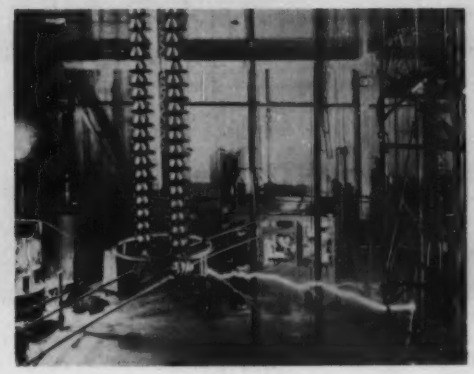
A-5768

Electrical World

Vol. 149, No. 23 JUNE 9, 1958

Published for 84 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

In This Week's Issue



CURRENT EVENTS

$5 Million EHV Research Charted

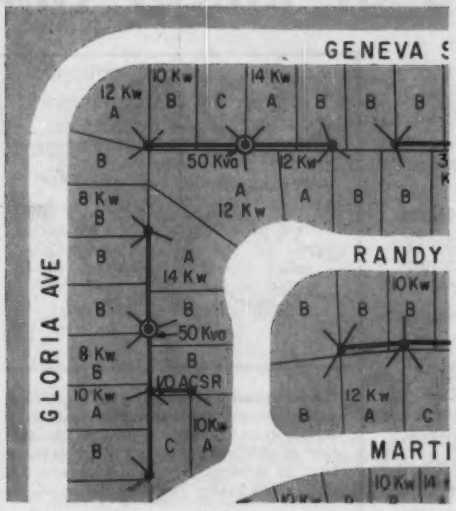
General Electric to build 460-750 Kv test line in western Massachusetts. Utilities, other manufacturers cooperate..p 54

MEETING REPORT

PA's Swap Cost-Cutting Ideas

Economy takes spotlight at EEI Purchasing & Stores meet as members exchange money-saving tips.....p 59

Special Report



Distribution to Serve High-Use Homes.....p 61

Voltage Boost Urged for All-Electric Homes

Robert F. Lawrence, Westinghouse Electric Corp
David K. Blake, General Electric Co
A. S. Anderson, Ebasco Services Inc

Three experts in distribution field move toward common ground in advocating trial of higher service voltages.....p 62

System Design to Serve Electric Space Heat

Wayne H. Johnson, American Electric Power Service Corp

Here's analysis of distribution system designed to serve all-electric home with conventional secondary voltage.....p 66

How Three Utilities Serve High-Use Home

R. M. Ziegler, Lousiana Power & Light Co
R. B. Friedrich, Kansas City P&L Co

Innovations adopted for serving the high-use customer are reported from Louisiana, Missouri, and Washington state..p 70

Departments

Editorials 53
• Electrical Week 19
Executive Reader 22
From the Publisher..... 5
How To 74
• Management Newsletter ..105
Manufacturers News 80
Meetings Calendar 128
New Equipment 88
News About People.....116
Selling 113
INDEX TO ADVERTISERS...128

PROVE IT FOR YOURSELF. CM-OT finish (left), with helically-wrapped corrugated bronze tape, withstands compression to a much greater degree than a Parkway-type finish with a flat metal tape twice the thickness (right).

CM-OT* gives more compressive strength with half the thickness of metal tape

Now you can have a high strength cable covering without resorting to bulky or hard to train direct burial constructions. Okonite CM-OT covering provides a light weight, flexible, small diameter cable of great compressive strength. It offers an excellent combination of installation and maintenance savings for many types of cables—control, communication, power or lighting.

Originally designed for direct burial, CM-OT cables are also readily installed aerially, in conduit, in racks or in underground ducts . . . permitting you to stock one type of cable for many uses.

The corrugated bronze tape that's the heart of the cable covering is permanently bonded to a tough wall of Okoprene, with an Okoprene-filled tape applied overall. This composite covering—bronze plus neoprene—provides a barrier against rodents, termites, moisture, oils or sunlight as well as corrosion by soil alkalies and acids. CM-OT also acts as a two-way cushion and "shield" against the stress of shifting stones and mechanical impact that might damage the vital conductor insulation in service. Electrically, the bronze tape serves as an excellent shield, and "ground" where necessary.

Where your environmental conditions demand different corrosion-resistant properties, CM-PF finish is available with Okoseal (polyvinyl chloride) or Okolene (polyethylene) bonded to the corrugated bronze tape instead of Okoprene. This should be considered particularly where petrochemicals are present.

Flexible . . . easy to handle, splice and terminate—CM-OT is a quality construction you'll find it profitable to become better acquainted with. For the full story, including actual test figures on the samples in the photograph, send for Bulletin EW-1121, The Okonite Company, Passaic, New Jersey.

Corrugation = strength plus lightness
Just as corrugated construction adds strength to underground pipes, so corrugation of shielding tape permits the construction of a stronger, lighter, more flexible and more easily handled cable—CM-OT.

*Patent No. 2722562

where there's electrical power . . . there's **OKONITE CABLE**

6130-A

The Women Were Chagrined

At the Shippingport Atomic Power Station dedication on May 26, everything went according to plan. Philip Fleger, board chairman of Duquesne Light introduced each foreign visitor without hesitation or mispronunciation—including Boris Paulov of the Union of Soviet Socialist Republics. Then Mark Cresap, president of Westinghouse, pointed up the significance of the project for the lay audience.

Finally came James E. Van Zandt, member of Congress, 20th district of Pennsylvania. He stood up and spoke like a man with a mission, and after he uttered his reprimand to Russia, it was obvious that that was his purpose.

He referred to a trip to Russia and said, " . . . we asked to see the large scale atomic power plants which the Soviets had previously claimed to be under construction. We were given unusual answers, delays and refusals. Does this mean the Soviets have abandoned their atomic power program, and are doing little or nothing to develop atoms for peace?"

This illustrates the tenor of his remarks—and it was this part of the program that upset the ladies and many of the men. They were embarrassed for the Russian. They felt that to a guest at the Shippingport dedication, Americans should show their manners not their vindictive spirit.

Fischer Black

Electrical World Staff

Fischer Black Publisher and Editor
Daniel T Braymer Assistant to the Editor

Engineering

Leonard M Olmsted Managing Technical Editor
John J Kearney Assistant Managing Technical Editor
Howard S Knowlton New England Editor, Boston
Edward Allen Midwestern Editor, Chicago
Francis J Kovalcik Middle Eastern Editor
David Rea Southeastern Editor, Atlanta
James G Plunkett Northeastern Editor
Charles F Hochgesang Western Editor, San Francisco
Rue M Shoop Associate Editor
George Swift Associate Editor
Kenneth N McLean Industrial Editor
Archer E Knowlton Consulting Editor

News

Herbert R Frankel Managing News Editor
Thomas R Jordan Commercial Editor
Theodore Fuller News Editor **Michael G Duerr** and **Denise McCarthy** Assistants
John D Damon Assistant Editor
George B Bryant, Jr Manager, Washington Bureau

Special Services

Arthur J Stegeman Manager, Market Research
Dexter M Keezer Director, Economics Department
E Russell Eggers Economist

Production

Jesse A Mock Manager of Production
Frank C Stockman Art Director
H Tomlinson Howland, Jr Associate Art Director

Advertising

Warren W Shaw Sales Manager
District Managers: N V Palmer; E S Chapin and D J Roberts, New York; E S Chapin, Boston; F P Coyle, Philadelphia; M S Kearney, Cleveland; M S Kearney, Pittsburgh; M I O'Connell, Detroit; W H Meneilley and J T Schaefer, Chicago; J T Schaefer, St. Louis; Russell Antles, Los Angeles; R C Alcorn and T H Carmody, San Francisco; Robert H Powell, Atlanta; Gordon Jones, Dallas.
Otto A Drechsel Business Manager
Donald K Ellis Promotion Manager

E Bryson Sessions Circulation Manager

ELECTRICAL WORLD
Vol. 149, No. 23 June 9, 1958

Published weekly by McGraw-Hill Publishing Co., Inc., James H. McGraw (1860-1948), Founder. Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at 99-129 North Broadway, Albany 1, N. Y. See panel at right for circulation regarding subscriptions or change of address.

Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice-President; L. Keith Goodrich, Vice-President and Treasurer; John J. Cooke, Secretary; Nelson Bond, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Joseph H. Allen, Vice-President and Director of Advertising Sales; A. R. Venezian, Vice-President and Circulation Coordinator.

Subscriptions are solicited from executive, supervisory, and engineering personnel in electric utilities, manufacturing companies, and related fields; and from consulting engineers and electrical engineers in industry. Position and company connection must be indicated on subscription orders. Send to address shown in box at right.

United States and Canada subscription rate for individuals in the field of the publication $6.00 per year; single copies 50 cents. Other Western Hemisphere and the Philippines $20.00 payable in advance and other countries $30.00 payable in advance.

Second-class mail privileges authorized at Albany, N. Y. Title registered in U. S. Patent Office.

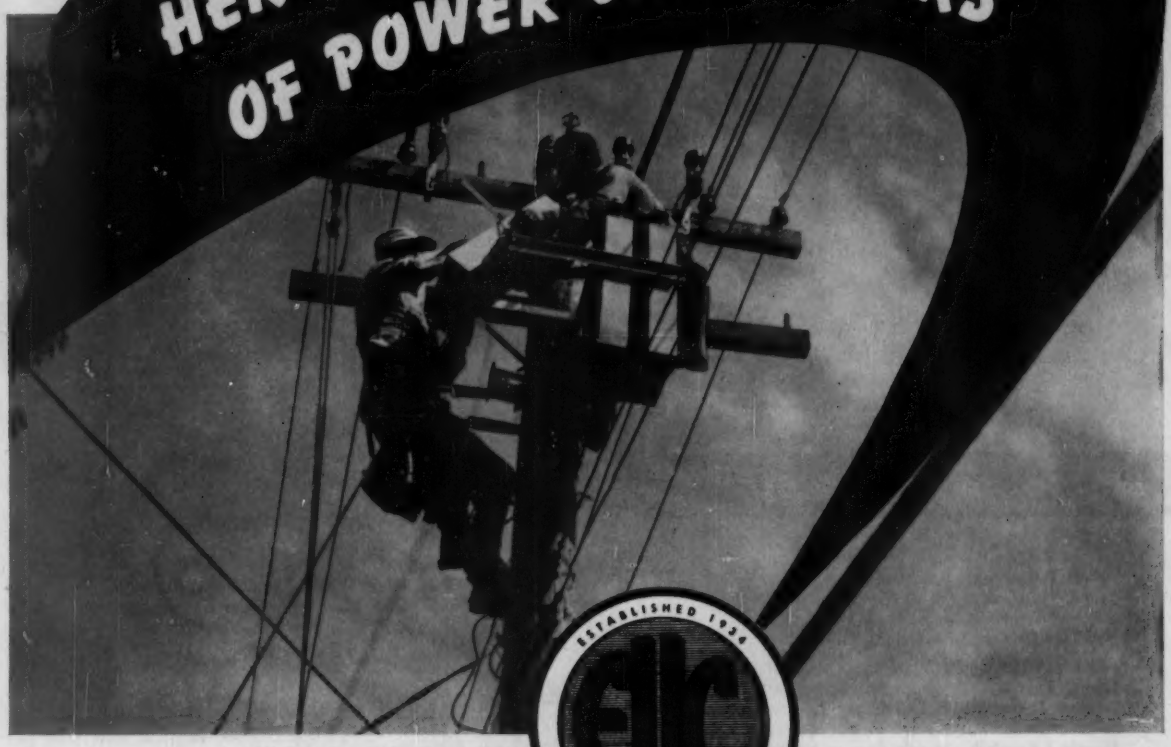
©Copyright 1958 McGraw-Hill Publishing Company, Inc. All rights reserved. Permission required to reproduce any of contents. Printed in U.S.A.

SUBSCRIPTION AND ADDRESS CHANGES: Send subscription correspondence and change of address to Fulfillment Manager, ELECTRICAL WORLD, 330 West 42nd Street, New York 36, N. Y. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address, and including postal zone number, if any. If possible, enclose an address label from a recent issue of the magazine. Please allow one month for change to become effective.

Postmaster . . . Please send form 3579 to Electrical World, 330 W. 42nd St., New York 36, N. Y.

DISTRIBUTION ENGINEERS:

HERE'S A COMPLETE LINE OF POWER CAPACITORS



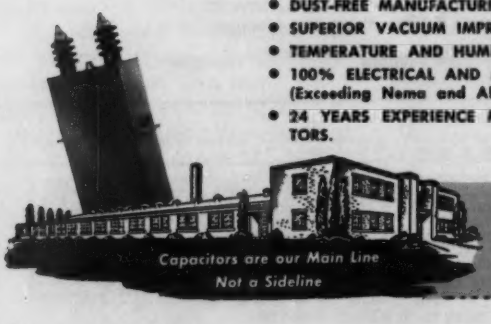
ESTABLISHED 1934

EUC

Now available in all standard sizes including 50 KVAR units, EUC capacitors are thoroughly tested in the field over many years. They are already on the approved list of many power companies and in service on many utility lines.

- METICULOUS QUALITY CONTROL.
- DUST-FREE MANUFACTURING FACILITIES.
- SUPERIOR VACUUM IMPREGNATION.
- TEMPERATURE AND HUMIDITY CONTROL.
- 100% ELECTRICAL AND MECHANICAL TESTS (Exceeding Nema and AIEE requirements).
- 24 YEARS EXPERIENCE MANUFACTURING CAPACITORS.

Our new application manual and catalog is packed with facts about capacitors. Drop us a note and we will send you a copy.



ELECTRICAL UTILITIES CO.

LA SALLE • ILLINOIS

TIME IS THE MEASURE OF ALL WOOD PRESERVATION

During working hours or leisure hours—if the topic is wood preservation, the question is, "Which method?"... For more than fifty years, major industrial users of wood have confirmed that the best answer is AMCRECO pressure treatment.

AMCRECO
PRESSURE TREATED WOOD PRODUCTS

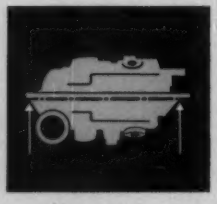
AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

Advanced Design

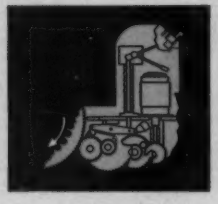
Allis-Chalmers tandem-compound steam turbine-generator units feature newest engineering developments

● From 75 mw through 250 mw, these 3600-rpm tandem-compound steam turbines utilize the most advanced design features, such as side-crossunders and primary and reheat steam valves that do not require removal during inspection, solidly bolted down non-sliding turbine pedestals, and flexibly supported hydrogen-cooled stator core.

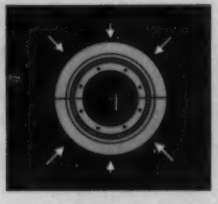
Advances in design of double and triple-flow tandem ratings to 250 mw and of 3600/3600-rpm and 3600/1800-rpm close-coupled cross-compound arrangements to 300 mw and larger are revealed in publications 03R8620 and 03R8880. Call your A-C representative for copies, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.



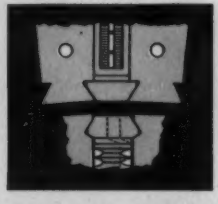
Centerline support of high-temperature turbine provides sustained concentricity of cylinder with spindle — offset parting joint adds rigidity to casing lower half without affecting the overall cylinder symmetry.



Side-mounted, underslung turning gear, for units with 23-inch exhaust blades and larger, engages shaft ring-gear below centerline — it need not be removed or electrically disconnected for unit servicing.



Ring-type nozzle chests, for 1000-1050-F inlet temperatures, are supported and keyed in inner casing, can expand freely, following spindle radial expansion. They also provide optimum nozzle orientation.

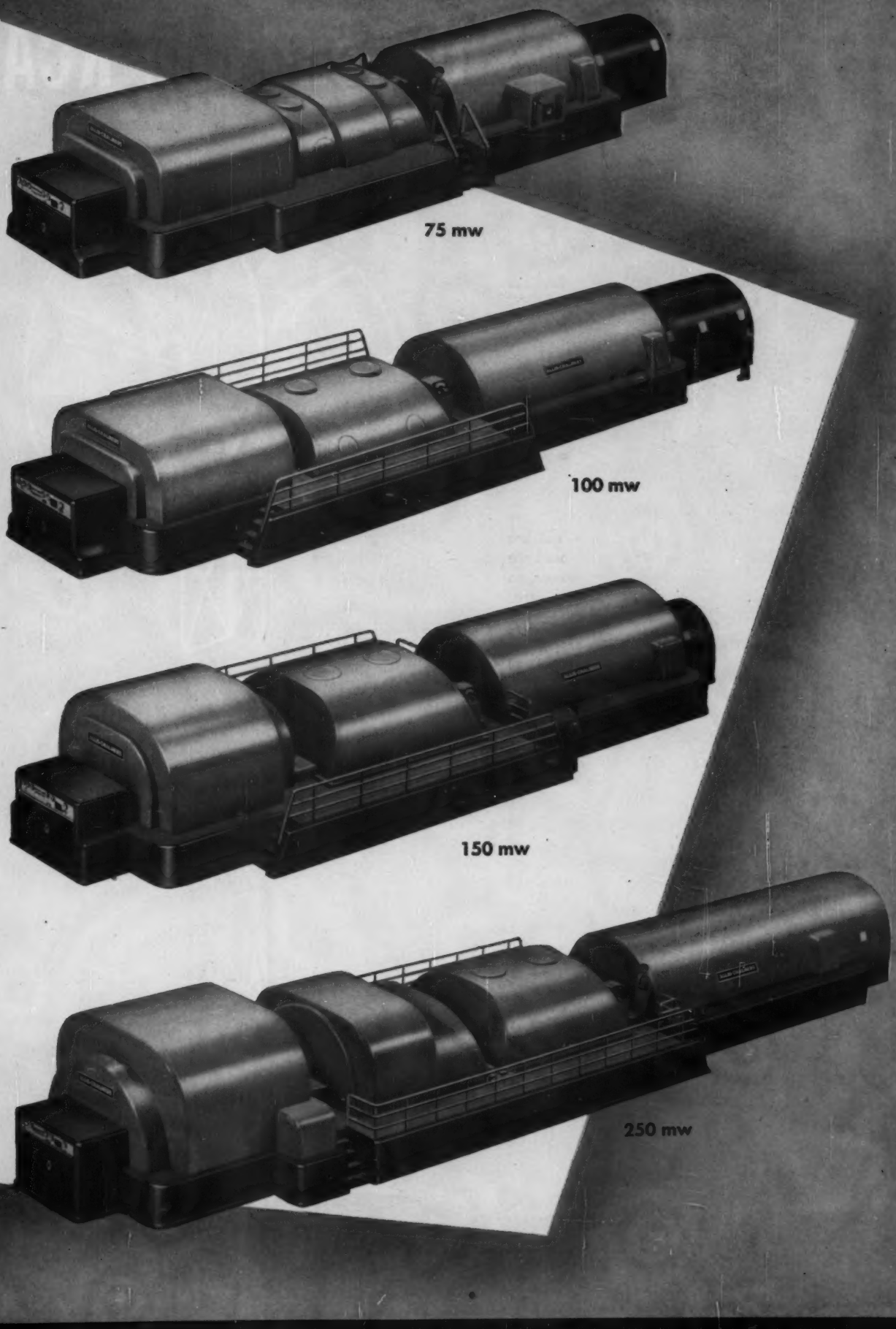


High-velocity supercharged hydrogen-cooling is employed in generator rotors for all 3600-rpm units over 50 mw—also in stators and their terminal conductors and bushings for units rated 150 mw and above.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS

A-5695


75 mw
100 mw
150 mw
250 mw

Dependable RCA

Microwave

KEEPS UTILITIES ON THE BEAM

In a tremendous surge of expansion, electric utilities are putting up new installations essential to the national economy, right across the nation.

RCA Microwave is providing these utilities with dependable communications systems, easily expandable, capable of handling every vital communication function including voice, teletype, telemetering, supervisory control, load control, relaying and transfer trip, facsimile, remote control, operation of mobile radio and others.

Through the use of microwave, voice or data intelligence reaches every part of the territory served and the whole system can be under the dispatcher's immediate control.

All this is accomplished with speed, efficiency, reliability and economy compatible with and, in most cases, superior to that provided by any other means—without high maintenance costs, expensive right-of-way problems, or vulnerability to weather vagaries.

ON PIPELINES—In the petroleum and natural gas industries where pipelines knife across the country, RCA Microwave systems link dispatching and control points with pumping stations and unattended remotely operated booster stations. Pipeline capacity is increased and operating costs are cut. VHF control channels allow immediate contact with maintenance personnel.

ON TURNPIKES—On the new cross-country superhighways RCA Microwave provides circuits for voice, facsimile, teletype, VHF control, traffic information and business machine communications . . . gives operating personnel complete control of the road, greater safety and service to driver patrons around the clock, in fair weather or foul.

RCA MICROWAVE provides the most advanced engineering features. Provision for the easy addition of future channels makes it the least expensive form of communication per channel mile. Equipment uses easy-to-service, familiar circuits and readily available tubes. Single sideband suppressed-carrier frequency division multiplex is used exclusively to meet high standards of dependability and quality of transmission. Frequency control for the system is concentrated at the terminal stations. And only *two* frequencies are usually required.

RCA TRU-TRIP—Power line faults—mechanical failures or circuit overloads caused by lightning or other physical damage—must be isolated in less than 1/10th of a second to minimize service disruption and prevent widespread loss. Within 1/100th of a second RCA TRU-TRIP initiates vital transfer tripping safety action by transmitting an alarm signal which triggers the proper combination of circuit breakers, to isolate the damaged line. This is a transistorized tone transmission system which instantly reacts to protect faulty high voltage power lines when alerted by the standard fault sensing relays of a power transmission system. Use RCA TRU-TRIP with either wireline or microwave systems.

RCA MICROWAVE is easily interconnected with mobile radio installations as well as existing telephone lines and switchboards. Field maintenance crews, no matter how remotely located, can be contacted from any station or office. Instant communication in the field means hours per day saved in parking.

OVER A MILLION CHANNEL MILES OF RCA MICROWAVE NOW IN SERVICE

RADIO CORPORATION OF AMERICA

Communications Products

Camden, N.J.

Radio Corporation of America
Communications Products—Dept. GB-45, Building 15-1, Camden, N.J.
In Canada: RCA VICTOR Company Limited, Montreal
Please send me complete information on:

☐ RCA Microwave Radio ☐ RCA TRU-TRIP

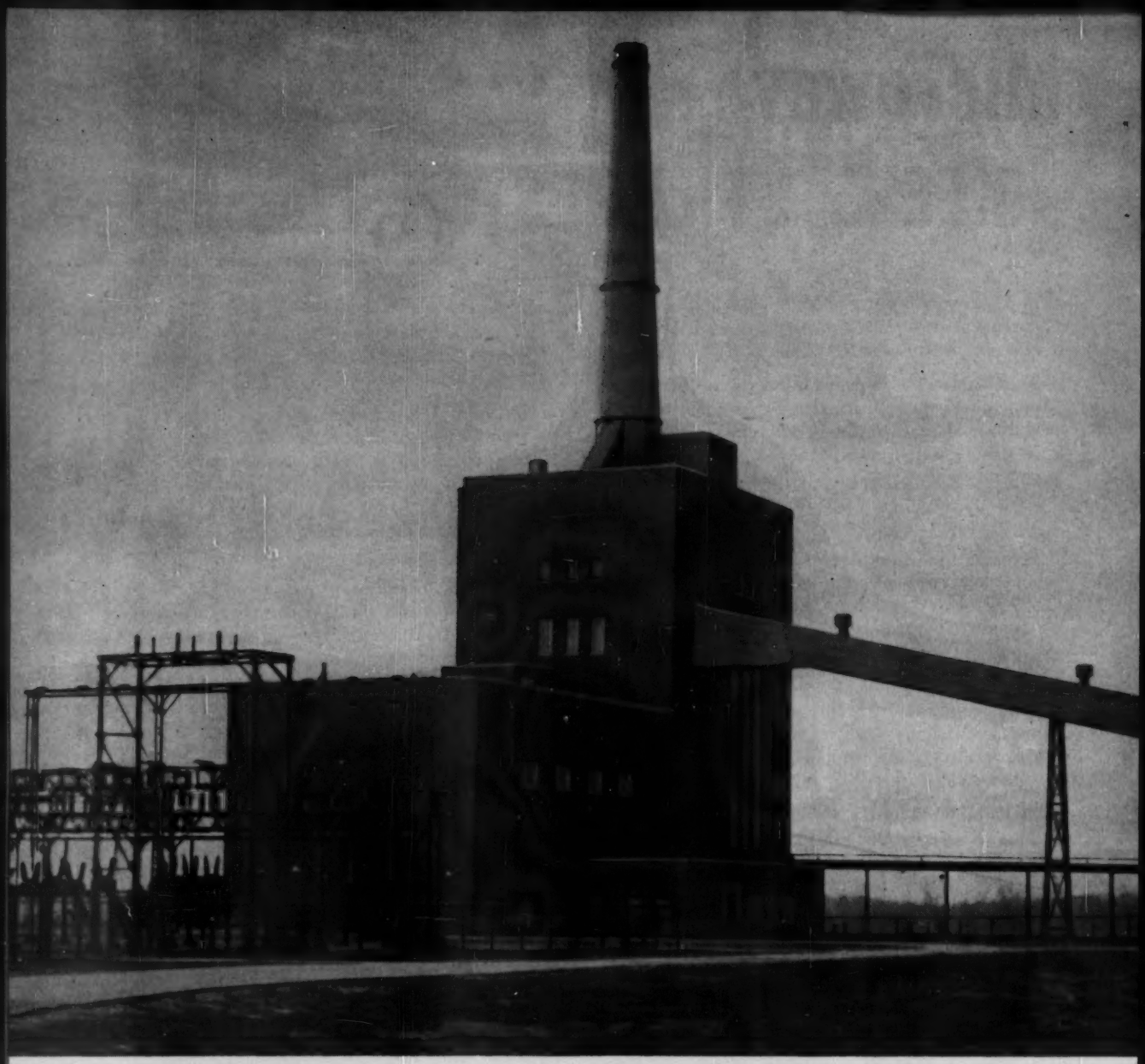
☐ Have RCA Communications specialist contact me.

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



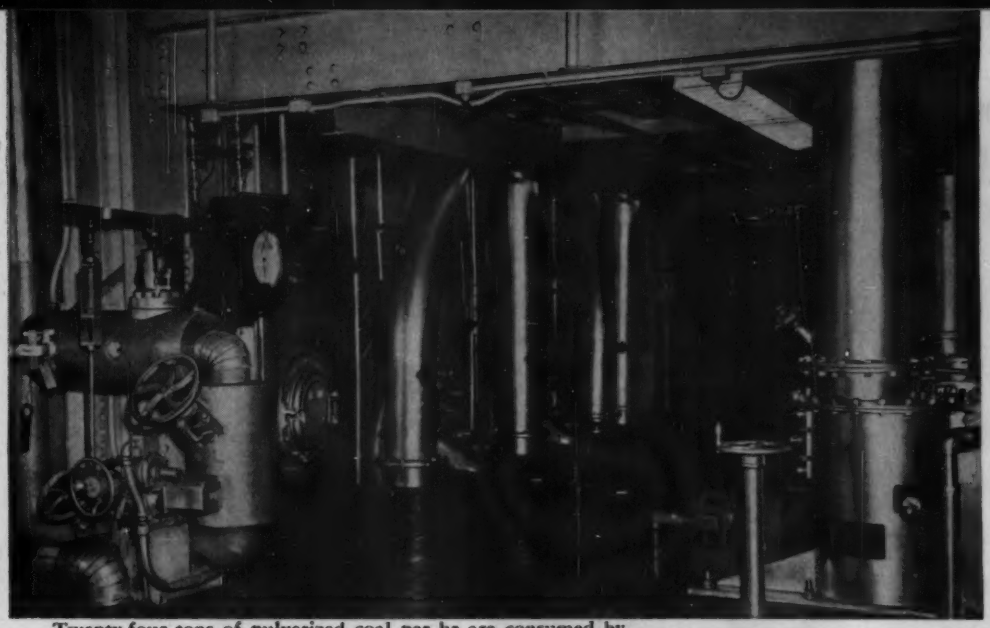
High Availability of B&W Boiler Brings

MORE LOW-COST POWER

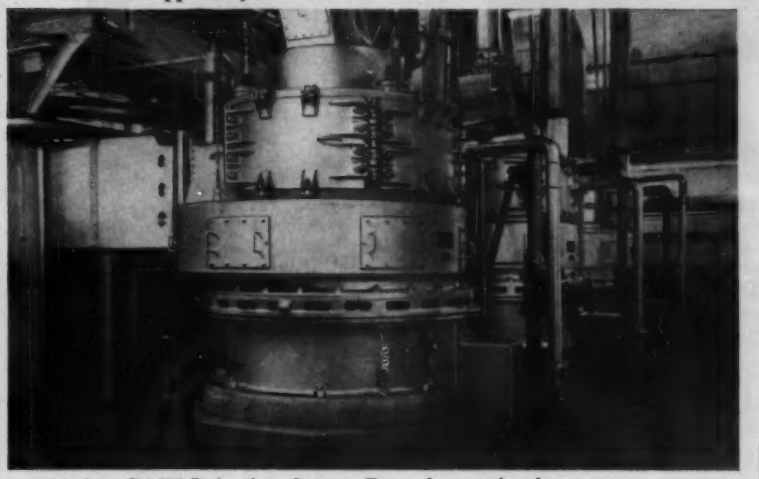
"Excellent availability and performance." After two years of operation, this is the report on the B&W Radiant Boiler purchased by the Southern Indiana Gas & Electric Company. The unit is on the line at the Culley Station near Evansville, where it provides more low-cost power for the growing area.

One major reason for the boiler's low operating and maintenance costs is the clean, dry steam assured by B&W Steam Separators. This keeps the turbine on the line for longer periods between cleanings and maintains higher turbine efficiency. Other important values include those made possible by B&W Pulverizers, which handle coal as received . . . wet or even iced . . . thus minimizing the danger of shutdown or loss of capacity. Pulverizers also grind coal to the specified fineness, thus assuring prompt ignition and complete combustion.

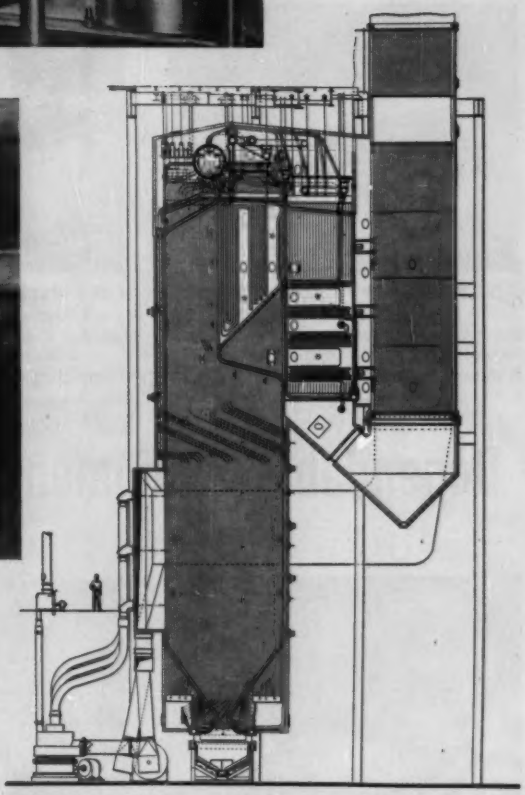
Advantages of B&W Boilers in central station operation are a result of B&W engineering advances in the development of economical energy, supported by nearly a century of steam generating experience.



Twenty-four tons of pulverized coal per hr are consumed by 6 burners supplied by 3 B&W Pulverizers.



Modern B&W Pulverizer System. Ease of operation is an outstanding feature of the B&W Pulverizer since the entire system automatically proportions the primary air and fuel, utilizing only one damper to accomplish load changes.



B&W Radiant Boiler at the Southern Indiana Gas & Electric Company's Culley Station has steam capacity of 437,000 lb per hour at 1290 psi at superheater outlet and 950 F. Designed pressure 1450 psi. Net generating unit capability 44,000 kw. Consulting engineers: Commonwealth Associates, Inc.

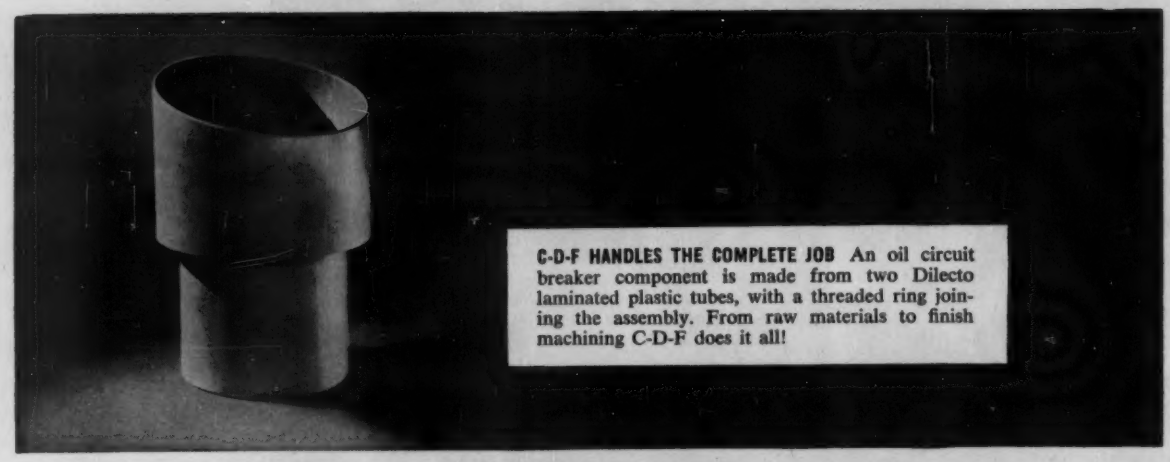
G-857-C5

TO INDIANA

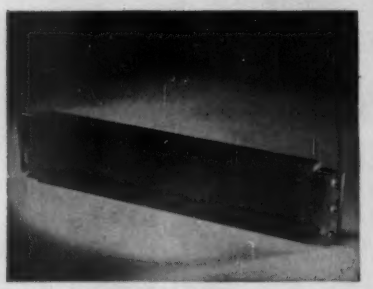
Important, too, for Southern Indiana Gas & Electric is B&W's national network of plants and engineers. Progressive electric companies and their consulting engineers continually turn to B&W research, development, engineering, and design for assistance and advice. This pool of knowledge is available to help you meet your central station requirements. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

BABCOCK & WILCOX

BOILER DIVISION

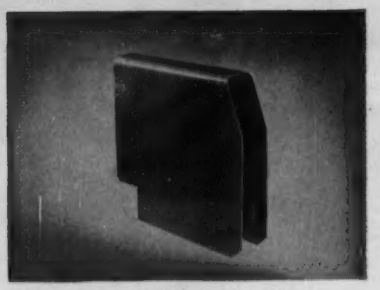


C-D-F HANDLES THE COMPLETE JOB An oil circuit breaker component is made from two Dilecto laminated plastic tubes, with a threaded ring joining the assembly. From raw materials to finish machining C-D-F does it all!



C-D-F KNOWS HOW TO MACHINE PLASTICS. A bus bar gets a covering of molded Dilecto over copper supplied by the customer. The plastic ends are skillfully trimmed on a smooth saw.

C-D-F MOLDS MANY SPECIALTIES. This shaft insulator for a circuit breaker is molded from C-D-F's cloth-based industrial thermosetting plastic, Celoron. Note complexity of mold, clean detailing.

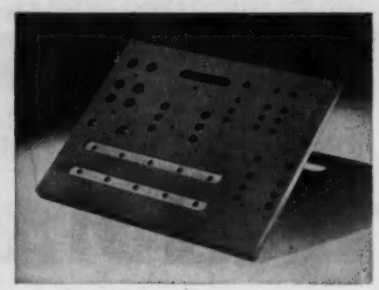


C-D-F USES MODERN METHODS. Large quantities of arc chute barriers are made from paper-based Dilecto. Operations include pressing, cutting, post-forming and trimming.

Dependable equipment relies on C D F insulation!

C-D-F OFFERS UNIQUE MATERIALS. This contact shaft for an air circuit breaker is another example of molded C-D-F Celoron used in switchgear because of its high impact strength.

C-D-F IS A SKILLFUL ASSEMBLER. Made from Grade C rolled Dilecto tubing, these pots are turned, bored, slotted. Then a macerated plastic end is inserted and arc resistant varnish finish applied.



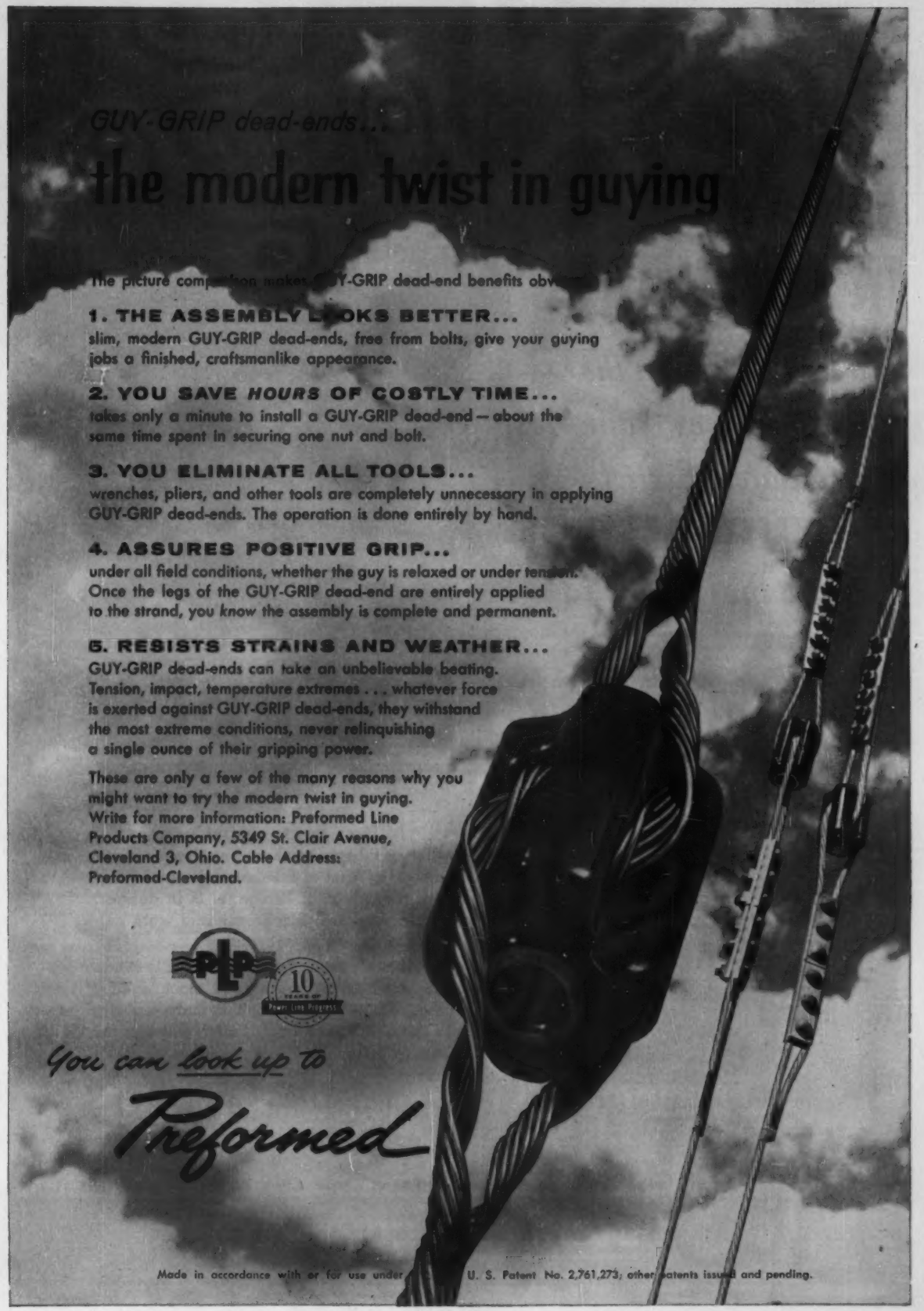
C-D-F UNDERSTANDS THE ELECTRICAL INDUSTRY'S NEEDS. Precisely machined to close tolerances, Dilecto panel boards guarantee dependable insulation, help designers save space.

See our catalog in Sweet's Design File for basic product data and sales offices. Write for detailed information, or send us your print for quotation.

CDF

CONTINENTAL-DIAMOND FIBRE

A SUBSIDIARY OF THE Budd COMPANY • NEWARK 15, DELAWARE

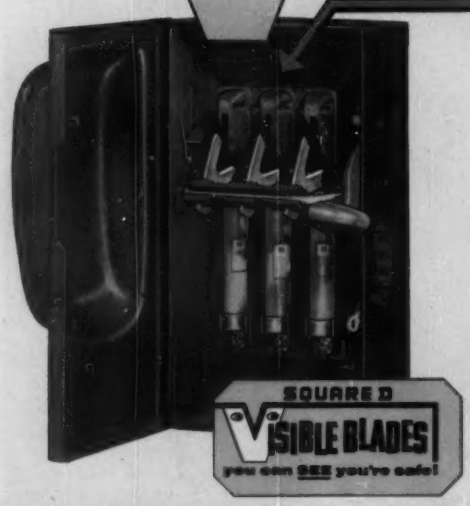

GUY-GRIP dead-ends...
the modern twist in guying
The picture comparison makes GUY-GRIP dead-end benefits obv
1. THE ASSEMBLY LOOKS BETTER...
slim, modern GUY-GRIP dead-ends, free from bolts, give your guying jobs a finished, craftsmanlike appearance.
2. YOU SAVE HOURS OF COSTLY TIME...
takes only a minute to install a GUY-GRIP dead-end — about the same time spent in securing one nut and bolt.
3. YOU ELIMINATE ALL TOOLS...
wrenches, pliers, and other tools are completely unnecessary in applying GUY-GRIP dead-ends. The operation is done entirely by hand.
4. ASSURES POSITIVE GRIP...
under all field conditions, whether the guy is relaxed or under tension. Once the legs of the GUY-GRIP dead-end are entirely applied to the strand, you know the assembly is complete and permanent.
5. RESISTS STRAINS AND WEATHER...
GUY-GRIP dead-ends can take an unbelievable beating. Tension, impact, temperature extremes . . . whatever force is exerted against GUY-GRIP dead-ends, they withstand the most extreme conditions, never relinquishing a single ounce of their gripping power.
These are only a few of the many reasons why you might want to try the modern twist in guying. Write for more information: Preformed Line Products Company, 5349 St. Clair Avenue, Cleveland 3, Ohio. Cable Address: Preformed-Cleveland.
PLP
10 YEARS OF Power Line Progress
You can look up to
Preformed
Made in accordance with or for use under U. S. Patent No. 2,761,273, other patents issued and pending.

ASK THE MEN IN THE PLANT!

They'll Tell You the Thing They Want Most in a Safety Switch is **SAFETY THEY CAN SEE**

—and that means

VISIBLE BLADES



The men who pull the switches will tell you what can happen when a switch, *believed* to be open—*isn't.* A lot of things can happen—and every one of them is bad. Personnel is in danger. Motors can single-phase. Machinery and work can be damaged. Down-time can skyrocket.

Doesn't it make sense to insist on Visible Blade construction which gives you a road block against any of those possibilities? Doesn't it make equally good sense to insist on the safety switch which gives you that construction—plus a lot of other performance advantages?

EC&M HEAVY INDUSTRY ELECTRICAL EQUIPMENT...NOW A PART OF THE SQUARE D LINE

SQUARE D COMPANY

new symmetrical interrupting ratings for XS Cutouts adjust lab results to field conditions

S&C matches actual ratings to system short-circuit calculations—

To simplify application, S&C has now provided symmetrical ratings for its distribution cutouts.

These new symmetrical ratings are provided because asymmetrical ratings are based on total available short-circuit current of the circuit, including the DC component. The asymmetrical ratings furnish a uniform, standardized measure of cutout performance, but they cannot, of course, be used directly in matching cutouts to system short-circuit calculations which yield *symmetrical* values.

The new symmetrical ratings bridge the gap and eliminate the possibility of "underprotecting" the system with a cutout of inadequate interrupting capacity, or "overprotecting" with a cutout of unnecessarily high interrupting capacity.

To arrive at a nominal set of symmetrical ratings, specific X/R ratios are assumed for the Heavy Duty XS and the Extra Heavy Duty XS,—8 and 12 respectively—typical of the conditions at locations where each of these cutouts is applied (see table at right).

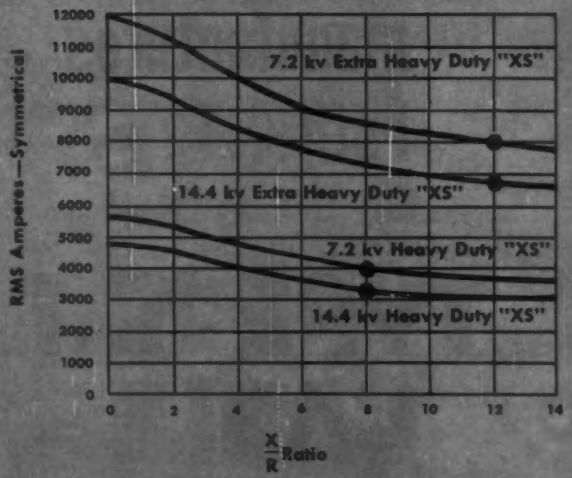
To enable the distribution engineer to take advantage of more favorable conditions—that is, where the X/R may be lower—special adjustment curves (shown to the right) are provided. These curves indicate the symmetrical interrupting ratings of the XS at other X/R ratios. (Those at 0 are the *actual* asymmetrical interrupting capacities of the XS, which may differ from the *nominal* asymmetrical ratings per NEMA standards.)

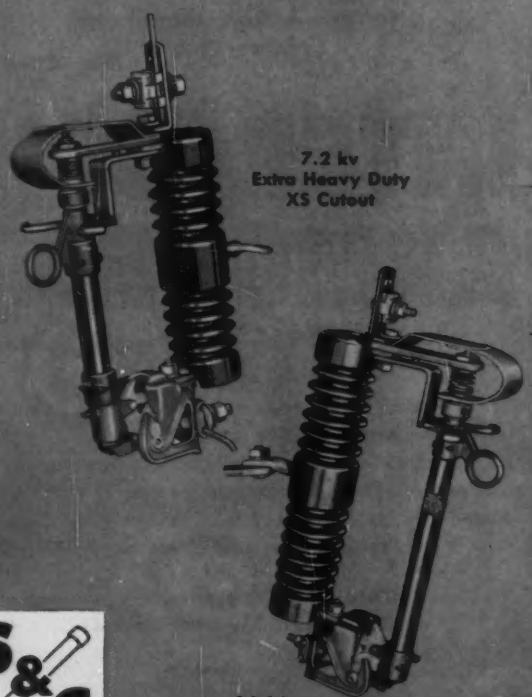
For further information, write for Descriptive Bulletin 511—providing full data on the XS Cutout—to S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario.

50/60 Cycle Short-Circuit "Nominal" Interrupting Ratings

Nominal Ratings kv	Amperes, RMS			
	Heavy Duty "XS"		Extra Heavy Duty "XS"	
	Asymmetrical	Symmetrical	Asymmetrical	Symmetrical
7.2	5000	4000	12000	8000
14.4	4000	3300	10000	6700

Adjustment Curves for Symmetrical Interrupting Ratings of XS Cutouts at various X/R Ratios.





7.2 kv Extra Heavy Duty XS Cutout

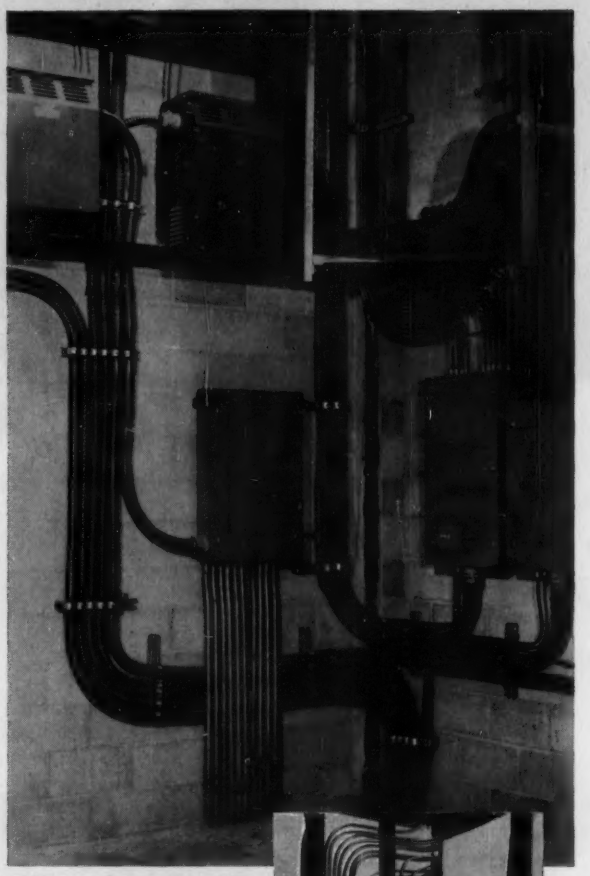
14.4 kv Heavy Duty XS Cutout

S&C ELECTRIC COMPANY

Power Fuses | Tool-Operated Disconnects | Open and Enclosed Cutouts | Load Interrupters | Metalclad Switchgear | "Loadbuster"

the right combination for industrial power needs!

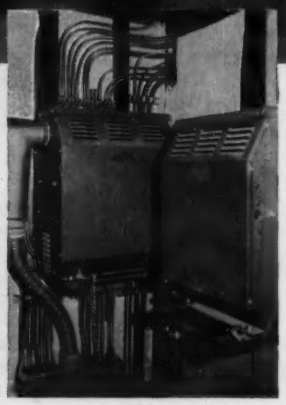
Only General Cable manufactures both...



Installation at the St. Regis Paper Company, Jacksonville, Fla. plant.

TYPE M.I. CABLE

for distribution, control and lighting circuits



INTERLOCKING ARMORED CABLE

for primary power feeder circuits

Easy to install in all locations, both Safety M I Cable and Interlocking Armored Cable require no mechanical protection, thus lowering costs of installation and minimizing space requirements. These constructions are easy to train around equipment or structural members, assuring the absolute minimum of interference, and present a neat, functional appearance. In addition, Safety M I Cable has unequalled physical and electrical properties: it is completely resistant to moisture, aging, nearly all chemicals, and operates at continuous high temperatures. For truly modern wiring in your plant, specify Safety M I Cable and Interlocking Armored Cable. And remember; only General Cable makes them both.

GENERAL CABLE CORPORATION 420 Lexington Avenue, New York 17, N. Y.
Offices and Distributing Centers Coast-to-Coast

for quality and service... **specify GENERAL CABLE**

The Electrical Week

FUTURE NEWS ▶ **Look for further action by state commissions in rate cases** as to why companies have not availed themselves of the accelerated methods of tax depreciation.

The growing season will spur a search for economical methods for retarding tree growth and cutting future line clearance costs.

LATE NEWS ▶ **"Hells Canyon Dam is dead,"** asserts Wayne Aspinall (D-Colo.), after House Interior subcommittee on irrigation and reclamation, which he heads, kills bill creating the controversial federal dam.

Oregon Republican State Central Committee approves the "concept" of a regional federal corporation for hydro development in the Columbia Basin.

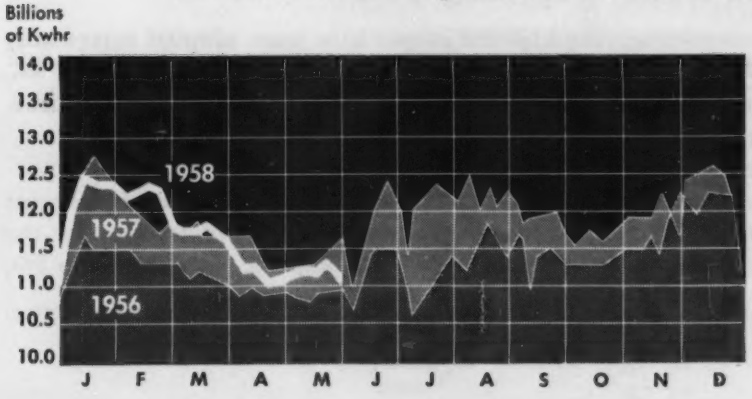
Niagara Mohawk asks PSC approval to up rates $10,452,000 a year. Company will retain only 47% of it, as federal, state, and municipal income and gross revenue taxes take the balance.

Preference power groups from eight states unite to form Midwest Electric Consumers Assn. It aims at "more low-cost power for all consumers" in Missouri River basin.

City of Memphis and TVA haggle over new power rate as old 20-year pact expires. TVA official contends higher rates Memphis must pay in next eight months, until its own steam plant is completed, are "the same any other city would pay for short-term power."

Management changes . . . J. L. Davis becomes executive VP of Tucson Gas, Electric Light & Power . . . New VP's of Con Ed are B. E. Gallagher and G. R. Hadden . . . Louisiana P&L ups A. E. Elliott, W. H. Senyard, and C. L. Osterberger to VP posts . . . Mississippi P&L makes C. E. Jones a VP . . . Northern States Power elects A. L. Burgess VP-treasurer.

POWER OUTPUT—Up 0.6% (Week ending May 31), Kwhr 11,000,000,000 (est.)



Per Cent Change From Previous Year

	May 17	May 24	May 31*	
Total U.S.	−2.3	−2.2	....	
New Eng.	+0.1	−1.4	....	
Mid. Atlantic ..	−2.7	−2.0	....	
Cent. Ind.	−5.9	−5.4	....	
West Cent.	+1.8	+2.6	....	
Southeast	−3.3	−2.9	....	
South Cent.	+1.8	−3.0	....	
Rocky Mount ..	+6.1	+9.4	....	
Pacific				
NW	−7.6	−12.4	....	
SW	+5.2	+9.2	....	

Seasonally Adjusted Index 223.8

Week Ago 221.8 Year Ago 222.5

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World Estimate). Excluding AEC, Output increase was 1.7%.

*Not available due to holiday.

EVENTS ▶ **GE launches Project EHV**—a coordinated five-year research plan with three main objectives: 1) increasing our knowledge of EHV transmission; 2) gaining operating experience at voltages from 460 to 750 kv; and 3) re-establishing the U. S. as a world leader in the EHV field. The $5-million project will include construction of a 4½-mi full-scale EHV transmission line (p 54).

What does the future hold for REA? Its leaders have many proposals for expansion and improvement but are split on the means to achieve them—private financing for larger systems, co-op banks, etc. Meanwhile, NRECA grows stronger (p 57).

DISTRIBUTION DESIGN ▶ **The trend toward all-electric living brings one big question** to the minds of distribution engineers: How can we serve heavier loads most efficiently and economically? Now, after studying the problem from all angles for the past few years, they've come up with some striking answers. In the special report starting on p 61, you'll find that:

The merits of 240/480 versus 120/240v are still being tossed around. But the two sides, personified by Westinghouse's R. F. Lawrence on the one hand and GE's D. K. Blake on the other, are drawing closer to one conclusion. Both advise trial use of higher service voltages as the best way to test its suitability for the future.

What we need now are actual cases to prove that higher secondary voltage systems are as practicable and economical as our studies indicate, contends Lawrence (p 62).

The industry will have to decide soon on whether to use 240/480v secondaries with autotransformers, says Blake, who contends hesitation may result in many lost opportunities (p 63).

We must consider the consumer's pocketbook in our debates over higher service voltage, asserts Ebasco's A. S. Anderson. Increased service voltage may boost appliance costs, he says (p 64).

Two essentials for adequate service in today's high-use homes are mechanical system design and proper primary and secondary voltages, claims AG&E's Wayne Johnson (p 66).

Schemes for serving high-use homes have been adopted successfully by Washington Water Power, Louisiana P&L, and Kansas City P&L. For a first hand report on the innovations practiced by these utilities, turn to their stories starting on p 70.

SUBSTATIONS ▶ **For those out-of-sight jobs, try using sound power phones,** suggests Toledo Ed. They've found all sorts of useful applications for the phones, from oil-transfer operations to moving transformers (p 76).

Re-usable canvas covers do a good job of shielding bushings from paint being sprayed on substation transformers, says TVA (p 76).

A new technique permits in-service checking of high-voltage bushing insulation by Seattle City Light. Method saves $1000 yearly **(p 74).**

DISTRIBUTION ▶ **You can raise current-carrying capacity** of UG cable pole risers by 6 to 12% by using ventilated cable riser caps, reports NEES **(p 74).**

MANAGEMENT ▶ **Coal will move into new areas as a utility boiler fuel** by 1975, and will strengthen its hold on markets where it now faces stiff competition from other fuels. The third and final "Report on Fuels" examines the West South Central, West North Central, Mountain, Pacific, and New England regions. Also included is a tabular summary of probable sources of electric generation in 1965 and 1975 for all nine regions of the U.S. **(p 105).**

SELLING ▶ **Washday was literally a bed of roses out** in Cincinnati recently, when CG&E staged a novel, and highly successful home laundry promotion. The drive not only attracted over 20,000 customer prospects; it also boosted CG&E's standing with manufacturers, dealers, etc **(p 113).**

INDUSTRIAL ▶ **Infrared lamps do a quick drying job on concrete columns** for a Sacramento Junior High School. The drying process, completed right at the construction site, resulted in considerable savings . . . A Baltimore printer finds electric fork lift and hand trucks are economical and efficient for handling printing supplies **(p 114).**

MANUFACTURERS ▶ **A 9,000-ft-long oil-filled cable, reportedly longest shipped to date,** will soon be on its way from Okonite to N.Y. Power Authority's Lake Champlain crossing. It's the first of four 115-kv paper-insulated cables slated for the project . . . Public Service E&G orders a second steam generator from Foster Wheeler for its Mercer station **(p 80)** . . . A power control unit for two-way radio systems, aimed at reducing interference, is now undergoing GE field tests **(p 82).**

NEW EQUIPMENT ▶ **Systems of 115 to 460 kv can obtain high speed interruption** with the high voltage air breakers recently introduced. The breakers, which use modular units, withstand maximum voltage recovery rate on transmission lines . . . A one-way ganged air break is now being made for single circuit switching of phase-over-phase lines in 34.5, 46, and 69 kv ratings . . . New on the market are bronze dead end clamps in five sizes. They have 0.18 to 0.98-in. clamping range **(p 88).**

PEOPLE ▶ **Philip Fleger takes on added responsibility as president** of Duquesne Light. He remains board chairman . . . Indiana & Michigan Electric gives Vice Pres R. E. Doyle, Jr, general manager's duties . . . At Iowa Public Service, G. A. Neal becomes board chairman; C. R. Beddows, vice chairman-controller; E. M. Raun, president **(p 116)** . . . Minnesota P&L elevates Axel Herbert to VP-general manager and Hubbell Carpenter to VP-chief engineer **(p 118).**

Average investment costs of steam generating stations of publicly owned utility systems was $168 per kw in 1956, according to the American Public Power Association's "Fourth Survey on Power Costs." In 1954 cost was $175 per kw. Average cost of power purchased from federal agencies was 0.36 cents per kwhr. Similar cost of power purchased from privately owned utilities was 0.94 cents per kwhr.—**Public Power, May, 1958.**

Fire-resistant lubricants will get additional tests in an operating steam turbine-generator of Duquesne Light Co this month. There has been an absence of basic research with the use of F-R lubricants and their possible harmful effects on generator insulation is still a problem. But utility operators see the advantages of F-R lubricants and stand ready to adopt them even at their higher costs.—**J. J. O'Connor, Power, May 1958.**

TECHNICAL NOTES

A "boiler inspection" of a gas turbine takes only about 2 to 4 hr depending on the unit. It involves only internal inspection of the combustion chamber with optical instruments.

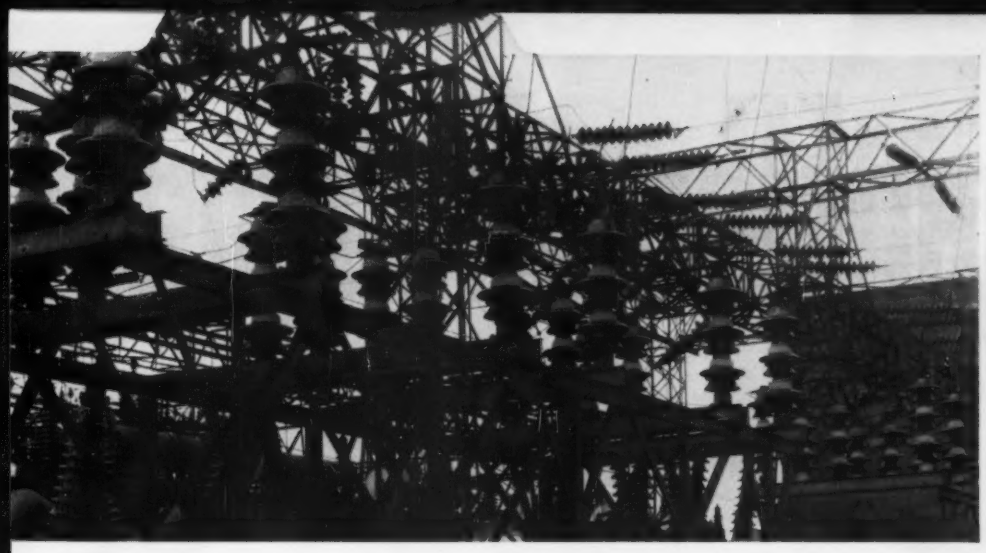
Generation at the distribution level on peak saves a high-cost loss increment and a high-cost investment increment. Of the two, the latter may well prove to be the dominant factor, as investment costs are a large portion of overall system costs.

Low nuclear fuel cost cannot be obtained with throwaway (e.g. not reprocessed) fuel of enrichment appreciably higher than the natural ratio.

FROM EDITORS IN THE FIELD

Aerial baskets will lift lineman to work areas on the future wood, plastic, concrete, or tubular steel poles. One versatile mobile tool will eliminate the need of steps on every pole, according to a Southwestern Gas & Electric Co engineer.

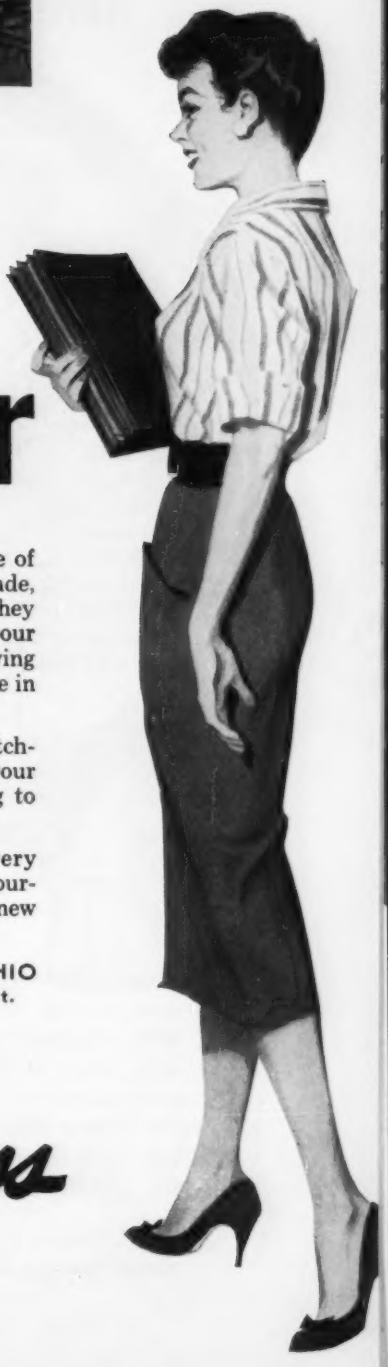
Salary savings will pay for remote control in 18 months at Bureau of Reclamation's Kortes hydro plant. Its three 12-Mw units will be controlled via two multi-conductor aerial cables by operators at Seminoe plant 2 miles upstream. Personnel at Kortes will be cut to 2 men from 12 now required.



Thirty-five years ago this station was built with O-B insulation. Records show a phenomenal service history that has led to many subsequent O-B installations in intervening years on the same system. Examination of your own past records will probably show similar facts — and suggest similar action.

ASK YOUR SECRETARY "WHAT'S THE BEST STATION INSULATOR BUY"?

She has the Answer



Records tell when substations were built, what make of insulation was used, what replacements have been made, and why. These are *your own records.* The facts they contain are on your own terms. In a few minutes, your secretary can lay before you the best reason for specifying O-B station insulators — and that reason may even be in your own handwriting!

With the facts before you — remembering that switchgear manufacturers will gladly supply insulators of your choice — be guided by your own experience relating to service life and maintenance expense.

To continue getting better mileage out of every insulation dollar, specify O-B insulators in your purchases of switches and unit subs, as well as in new stations of your own construction.

OHIO BRASS COMPANY, MANSFIELD, OHIO
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass

Bigger Electrically...

Inside

Dynagap protective elements are identical, whether used in a 2,400-volt distribution model or a 345,000-volt heavy duty station type. The only basic difference is number.

This imparts to the distribution class -- for the first time -- an entirely new order of durability, plus high sensitivity. The result is a degree of service protection radically new in the distribution field.

Thorex Dynagap distribution arresters offer some entirely new ideas in the protection of both equipment and service continuity. They bring many of the elements of Station Class performance to distribution systems. Never before have interchangeable principal elements been applied to arresters in such widely varying application.

The Dynagap is a major breakthrough in arrester development; transferring the bulk of the valve action away from the valve blocks and into the gap structure, and thus permitting important new techniques in block composition. These are concentrated largely in the direction of vastly increased durability without sacrifice of other functions.

For protection of a new high order -- without a cost premium -- put Thorex Dynagap arresters on your distribution system.

OHIO BRASS COMPANY, MANSFIELD, OHIO

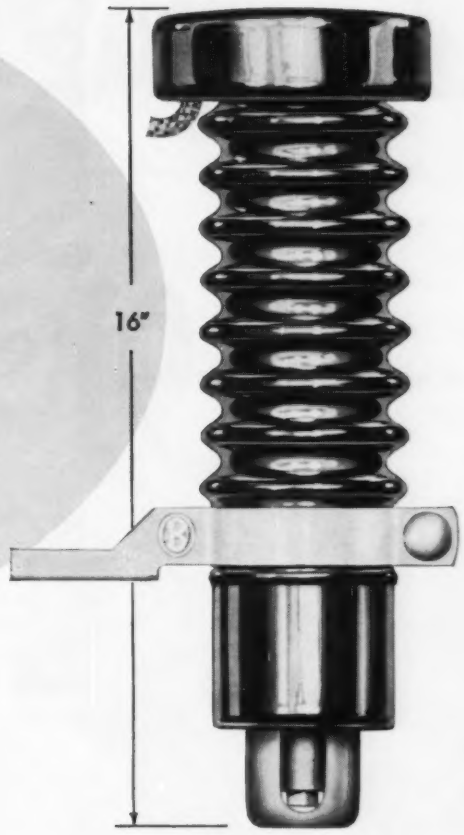
Smaller Mechanically

MORE PROTECTION...BETTER PROTECTION...IS YOURS WITH NEW THOREX DYNAGAP DISTRIBUTION LIGHTNING ARRESTERS

Outside

With its unequalled efficiency and protective ability, the new Dynagap element accomplishes a drastic reduction in size compared to voltage rating.

Dynagap-equipped Thorex distribution arresters are substantially smaller than equivalent types. At the higher voltage range (18 kv) where size is a particular factor, the arrester is approximately one-half the height of some comparable models.

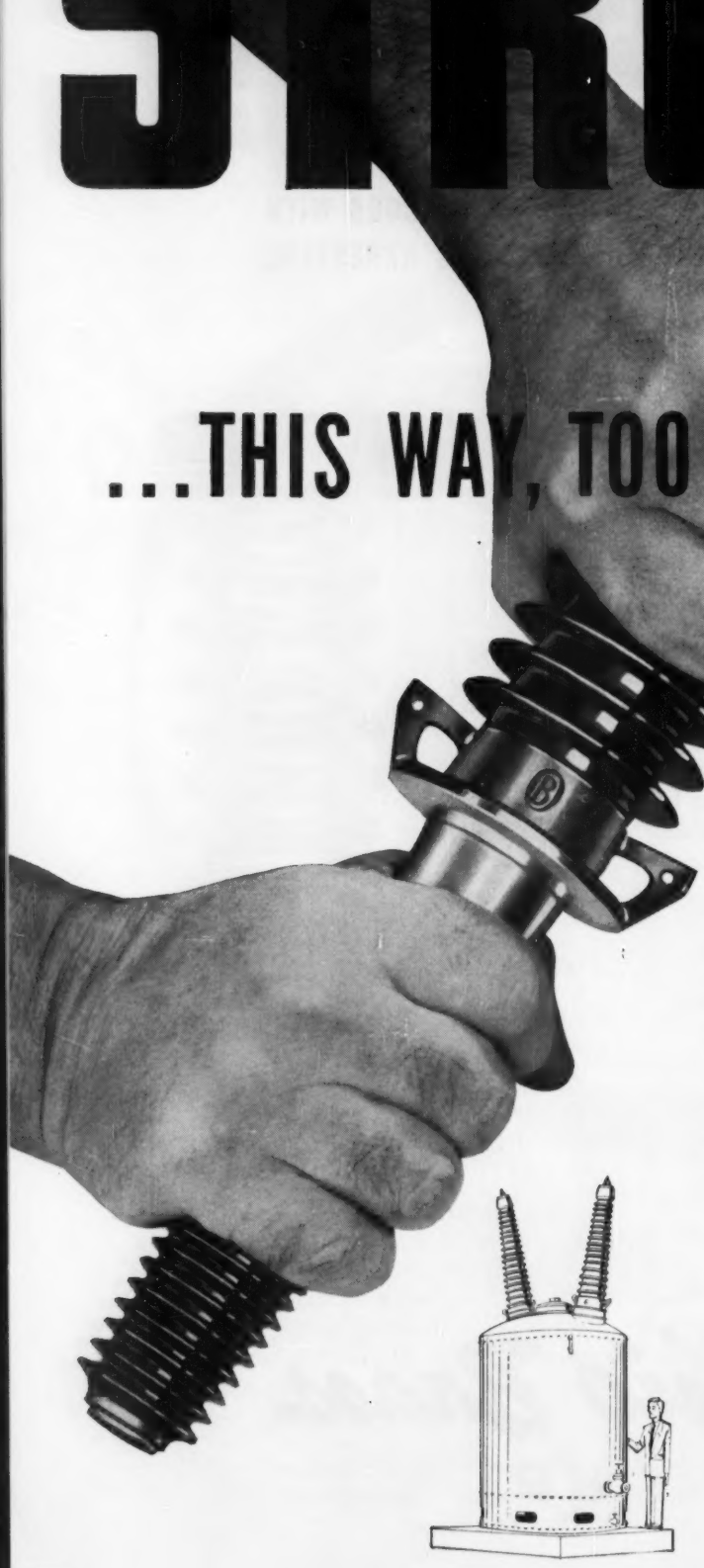


12-KV SIZE

Ohio Brass

STRONG

...THIS WAY, TOO!



Rigid Insulating Core Contributes To High Mechanical Strength of O-B Bushings

Exceptionally strong, rigid insulating cores are one result of O-B's modern condenser bushing manufacturing methods. This source of extra strength is not wasted. Flange and ground sleeve are designed to contact this core at strategic points to exploit its stiffness. The result is a bushing as strong, or stronger than its predecessor, which for many years served so well on the highest rated oil circuit breakers.

Fifty years of priceless experience and excellent reputation stand behind today's O-B bushing. It is the product of a completely new plant.

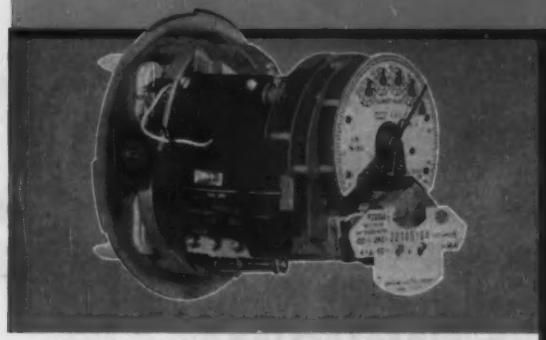
For ingenious design and downright dependability, specify O-B on your new station equipment.

OHIO BRASS COMPANY, MANSFIELD, OHIO

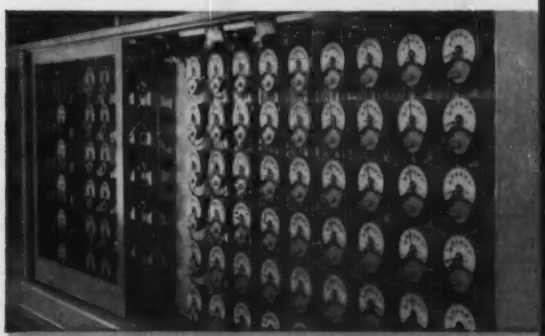
Ohio Brass

4881-H

NEW... SANGAMO MECHANICAL DEMAND METERS



Sangamo's new two-stator four-wire delta meter with a Type D Mechanical Demand Register installed. Meter disk is readily visible from any angle.



Every Type D Mechanical Demand Register is thoroughly tested for accuracy. This group of registers is being given time run tests in the Sangamo factory.

SM58-5

Type P2D

with a new concept in Mechanical Demand Registers

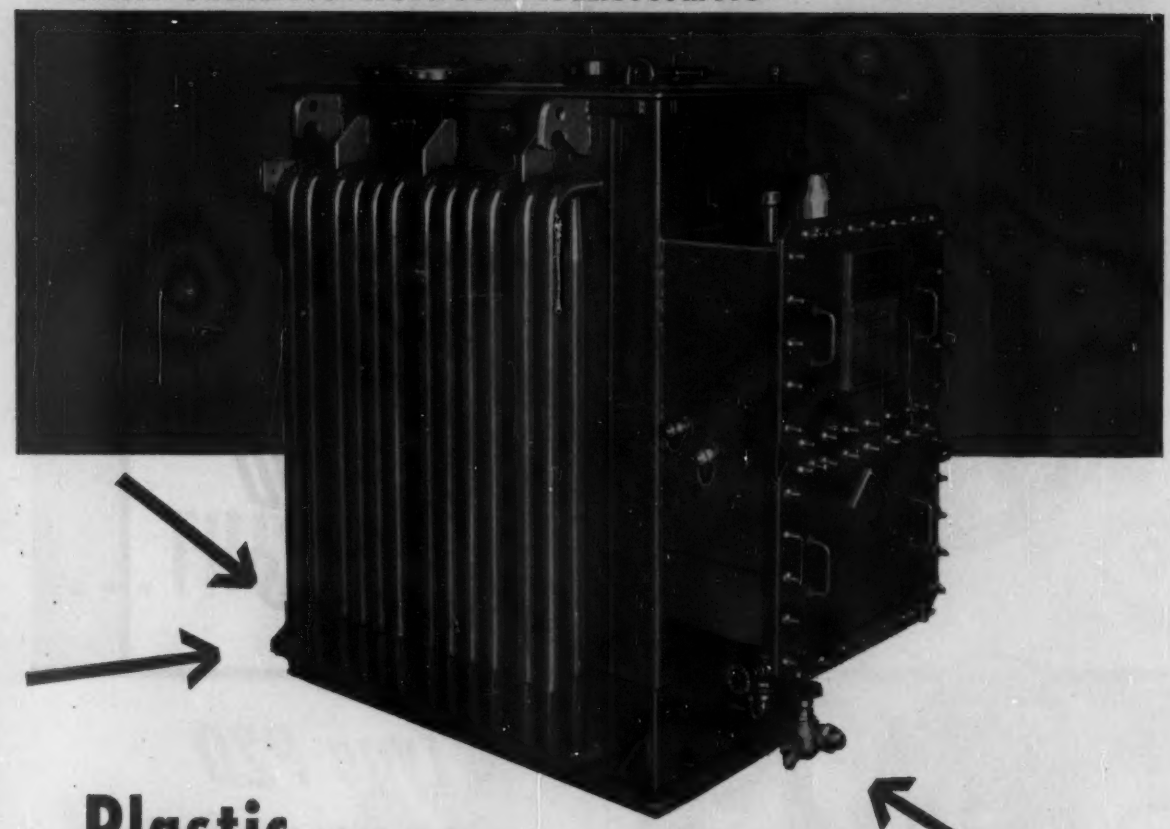
Sangamo's new Type D Mechanical Demand Register, when installed on any of the Sangamo Type P2 extended range watthour meters, accurately measures KW demand on all polyphase loads.

Universal and standard Type D Registers have—*full scale capacities* to match both Class 100 and 200 meters —time interval indicator—*clutch free* arrangement for disengagement of the timing motor with *no* mesh adjustment.

Trouble free service is assured by—the proven Sangamo slow speed, high torque timing motor—timing gear shafts with polished stainless steel pivots—permanently lubricated porous bronze bearings—jeweled and nylon thrust bearings—and Sangamo's field proven, clutch free gravity reset mechanism.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

Allis-Chalmers Network Transformers



Plastic Jacket protects bottom and lower walls against corrosion

In many locations, the network transformer often has to stand in inches of water from time to time. That's the very reason why Allis-Chalmers applies plastic compound on the bottom and a foot up the tank walls. Water can't seep through it. Destructive corrosion just can't get its teeth through this tough tar-base material.

Special overall protection, too

The overall surface treatment given an Allis-Chalmers network transformer is outstanding in itself. After grit-blasting and steam cleaning, tanks are given three coats of phenolic paint. Each coat is specially formulated to resist moisture . . . flowed on to assure complete coverage . . . baked on for permanency.

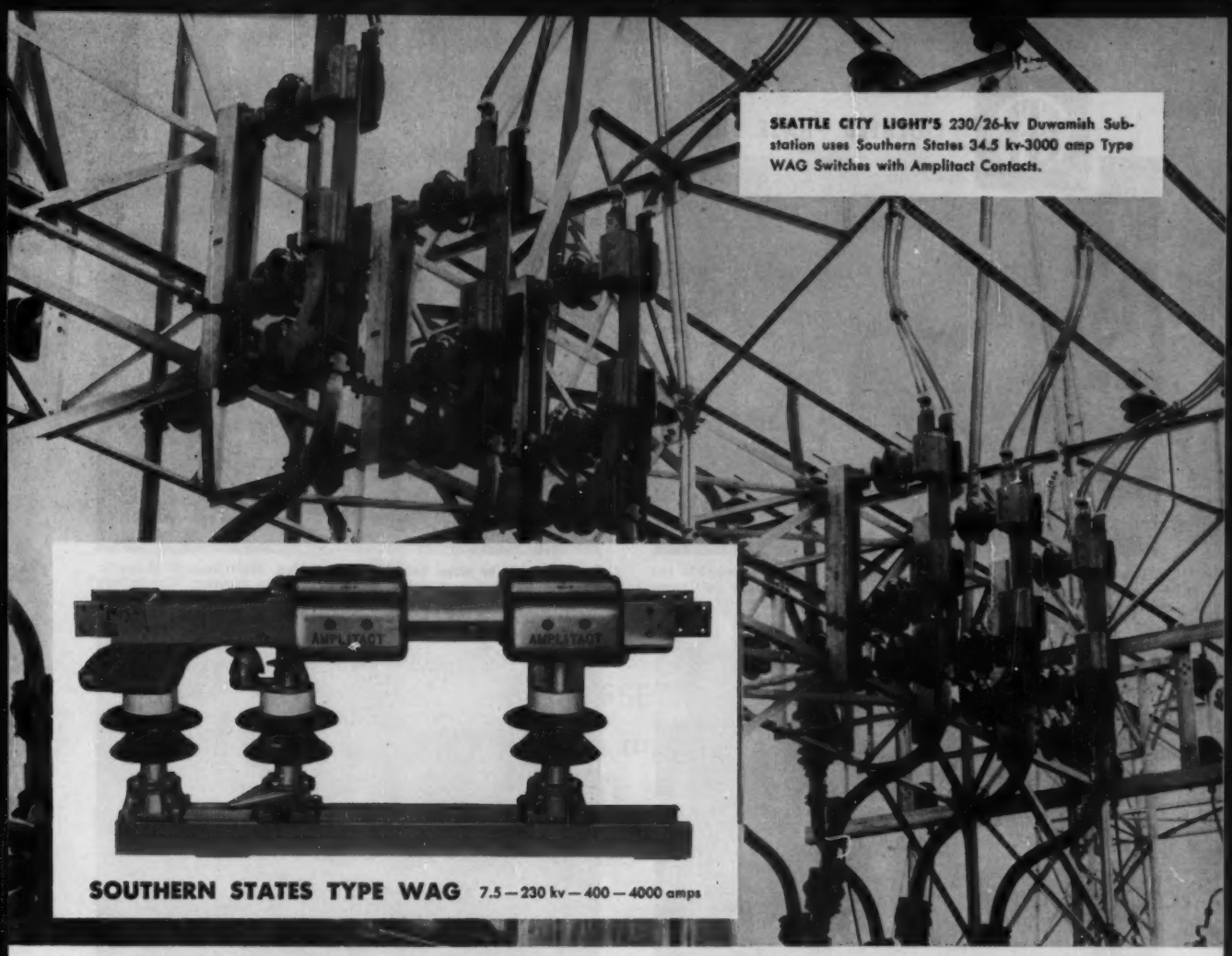
An extra measure of protection

An extra measure of surface protection is just one of the many reasons why Allis-Chalmers transformers rate high with utilities and consultants everywhere. Get all the facts. Call your nearby A-C district office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.

A-C ALLIS-CHALMERS

A-5609

ALLIS-CHALMERS



SEATTLE CITY LIGHT'S 230/26-kv Duwamish Substation uses Southern States 34.5 kv-3000 amp Type WAG Switches with Amplitact Contacts.

SOUTHERN STATES TYPE WAG 7.5—230 kv—400—4000 amps

The Man-sized Switch for Man-sized Jobs

FIG. 1

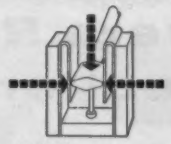


FIG. 2

AMPLITACT® CONTACTS ON WAG

High pressure Amplitact contacts provide maximum dependability under high current short-circuit conditions. The arrows in Fig. 1 show direction and relative magnitude of electromagnetic forces induced when switch is subjected to fault current.

The resultant electromagnetic forces, as shown in Fig. 2, greatly increase contact pressure and positively hold blade in the engaged position. For complete details, write for Bulletin 56AM on the Amplitact.

"Don't send a boy to do a man's job" is a saying especially applicable when choosing switchgear that must safely carry 3000-4000 amperes. Not only must it be capable of carrying such loads after years of service, but it may be called on to withstand fault currents up to 120,000 amperes without damage.

It's a man-sized job. Dirt, industrial waste, years of exposure to every type of contamination make the job even tougher. It takes a man-sized switch!

The Type WAG illustrated above is a good example. It's big and tough enough to carry its rated load continuously without excessive temperature rise. A built in safety factor more than compensates for the deteriorating effects of long, hard service. Amplitact® contacts provide high pressure for handling the heaviest faults.

The WAG is finding wider and wider acceptance in all ratings. It's now in service in virtually every state in the union.

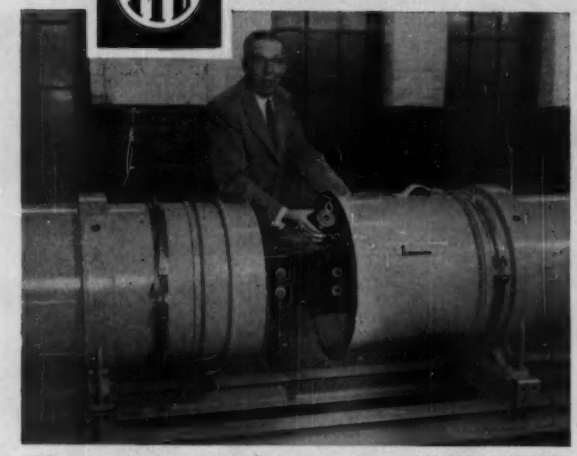
Get complete details from your Southern States representatives or write direct for our latest bulletin.

LIVE BETTER ELECTRICALLY

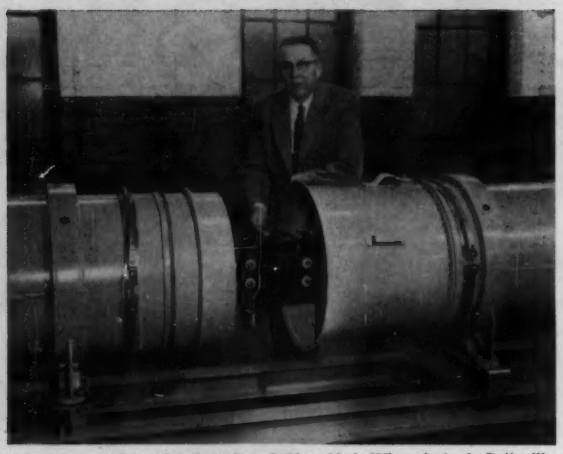
SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

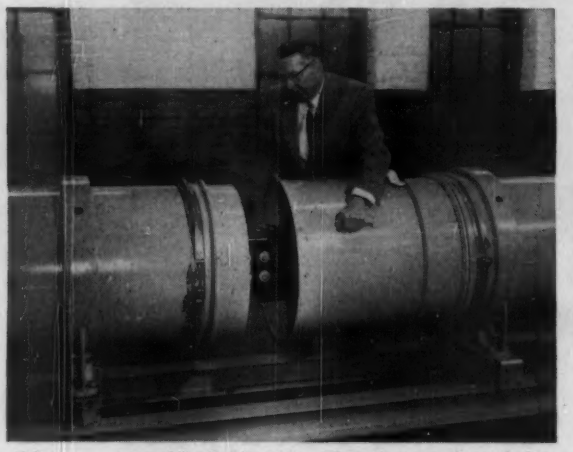
ISOLATED PHASE BUS



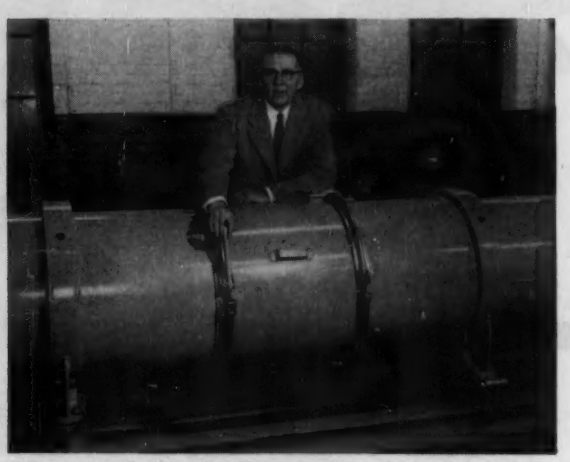
Sliding cover in open position. Connectors are easily accessible for assembly and maintenance. High-strength wet porcelain insulators, mounted in compression, are easily reached for inspection and removal.



Connectors can be either bolted or field welded. When bolted, Belleville washers are used to maintain adequate contact pressure. Conductors are either copper or aluminum. All copper connections are silver plated.



Sliding cover in partially closed position. Flanged cover, flanged rings, lifetime silicone rubber gaskets and clamping bands provide a positive seal, prevent dust accumulation, simplify opening and closing.



Sliding cover in closed position. Closure requires only two 1-piece lifetime silicone rubber gaskets—easy to place and remove. Simple, powerful V-clamp band exerts pressure uniformly around the flanged rings.

How I-T-E Sliding Covers Reduce Installation and Inspection Time

Sliding covers, well located, to facilitate joint makeup and inspection are one of the many money-saving advantages of I-T-E Isolated Phase Bus. Others include the most simple and efficient of designs; greatest installation flexibility; light weight to save installation time, labor cost, and structural steel; quick, reliable engineering; and excellent delivery.

I-T-E Isolated Phase Bus is available in ratings through 138 kv, through 20,000 amp. Self and forced-air cooled. Send today for Bulletins 10004-A and 10004-B, giving complete information. I-T-E Circuit Breaker Company, Switchgear Division, 19th & Hamilton Sts., Philadelphia 30, Pa. In Canada: Eastern Power Devices Ltd., Toronto, Ontario.

I-T-E CIRCUIT BREAKER COMPANY
PHILADELPHIA, PENNSYLVANIA

a compression tap WITHOUT corrosive drip

Patent Pending

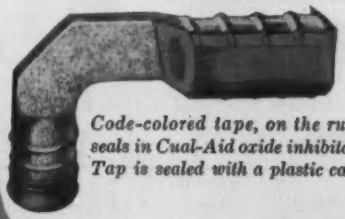
Drip from a Copper run does not fall on Aluminum Tap— and cause Corrosion

Penn-L-Tap has new OFFSET Design— with Run and Tap on OPPOSITE sides of the L-bar

Quick— and Dependable. The Penn-L-Tap is quickly hooked over the run and crimped by any standard crimping tool. Especially convenient for tap off a hot run.

Made from pure aluminum. Usable on all combinations of aluminum-to-copper or aluminum-to-aluminum.

Completely marked for conductor accommodations— color-coded at both ends. The run end is sealed with easily removable code-colored tape. The tap end is closed with an easily punctured transparent code-colored cap, which need not be removed when inserting the tap and crimping. Packed in boxes with color-coded labels.



Code-colored tape, on the run, seals in Cual-Aid oxide inhibitor. Tap is sealed with a plastic cap.

Conductor range: For Taps from 10 STR to 2 STR (or 2 ACSR). For runs from 6 STR (or 6 SOL) to 2 STR. 15 conductor combinations.

Get Top Efficiency in all your ALUMINUM COMPRESSION FITTINGS—write for sample of the better designed Penn-L-Tap. Write to Penn-Union Electric Corp., Erie, Pa. *Our 30th year . . . Serving the Electrical Industry.*

There's a NEW and BETTER way at PENN-UNION

I HAD THE BOSS UP A POLE...

"He knew all about the operating advantages of polyethylene coated wire . . . but I took him up and showed him why I liked it and why it's saving the company even more money than he figured."

In the past 12 years polyethylene covered line wire and cable have chalked up outstanding service records for utilities. But some of the best reasons for using polyethylene coatings don't turn up in operating statistics —they come from the men whose job it is to install and maintain the lines . . . Reasons such as these:

Polyethylene Is Easier to Install

It's free stripping, yet has excellent adhesion and will not ruffle over cross arms. It's clean to work with and its surface is "slippery" too. Polyethylene coating is lighter than other types of covering . . . it handles easier.

Polyethylene Covered Line Wire Saves Outages

Polyethylene forms a complete and permanent covering over line wire. That means fewer outages from contact with trees, wind-blown swinging wires and foreign objects. Smaller diameter polyethylene coatings offer less wind resistance above ground. Lighter weight can be an advantage, too, in ice storms.

In field servicing . . . in over-all performance and service life—polyethylene has proved its superiority in wire and cable applications such as these:

- Line wire covering
- Power cable dielectric
- Tree wire covering
- GTO (Neon Sign) Cable
- Coaxial Cable
- WD-1 Infantry Field Wire
- Control cable insulation and jacket
- Communication cable insulation and sheaths
- Corrosion protection for metal sheaths.
- TV Lead Wire

When you order polyethylene covered wire and cable, ask your supplier about the superior weather and stress crack resistance of polyethylene made with PETROTHENE® polyethylene resins. PETROTHENE quality costs no more.

USI INDUSTRIAL CHEMICALS CO.
Division of National Distillers and Chemical Corp.
99 Park Ave., New York 16, N. Y.
Branches in principal cities

Makers of PETROTHENE Polyethylene Resins

reflective markings end danger after dark

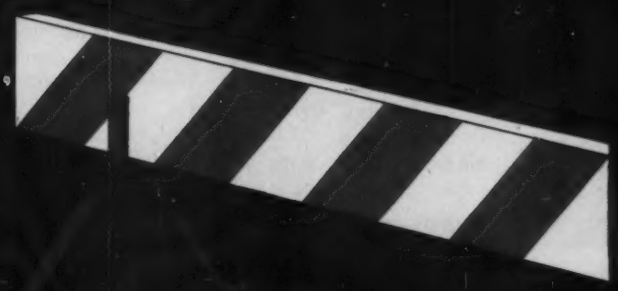
Where there is danger, colorful markings of bright "Scotchlite" Reflective Sheeting flash a vivid warning to nighttime motorists. These durable, low-cost markings protect your own equipment, too. You show your concern for public safety. And you remind the public of your vital 24-hour-a-day service. Send for informative free booklet today.

REG. U. S. PAT. OFF.

SCOTCHLITE

BRAND

REFLECTIVE SHEETING



MINNESOTA MINING AND MANUFACTURING COMPANY
where RESEARCH is the key to tomorrow

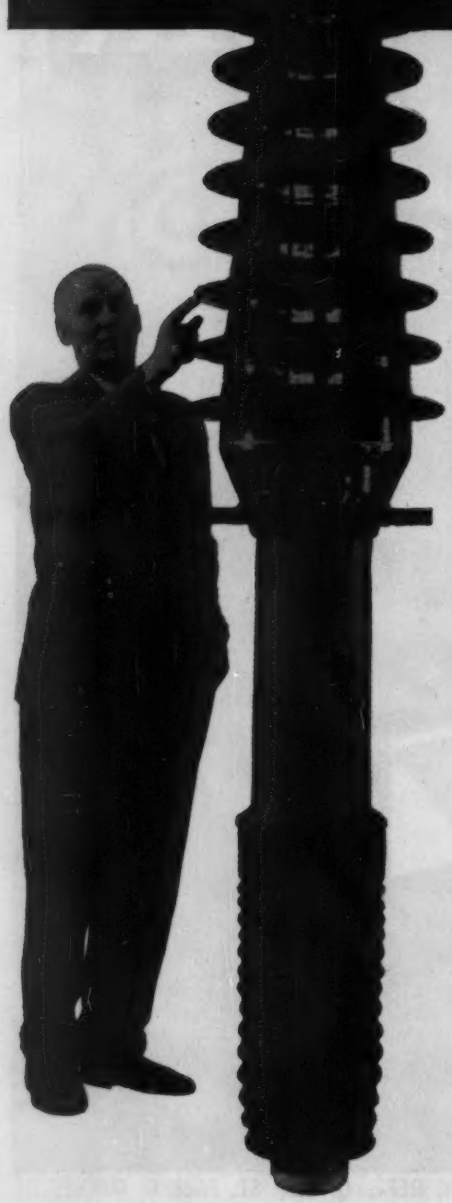
PRODUCT OF 3M COMPANY RESEARCH

The term "Scotchlite" is a registered 3M Company trademark

FOR FREE BOOKLET ON REFLECTIVE MARKINGS, WRITE 3M COMPANY, DEPT. QW-698, ST. PAUL 6, MINNESOTA

Westinghouse Type "O"... only service-proved ASA bushing

Includes ratings 92 through 196kv



Westinghouse Type "O" bushings have an unmatched service record—demonstrated by over 300,000 bushing years of trouble-free service. Because new ASA dimensional requirements were achieved with no basic change in design, this is the only ASA bushing that is service-proved. Type "O" bushings offer plus values derived from over 50 years of Westinghouse leadership in condenser bushing design. Continuous research and development—made possible through PLOWBACK OF EARNINGS by Westinghouse—have produced these extra bushing features:

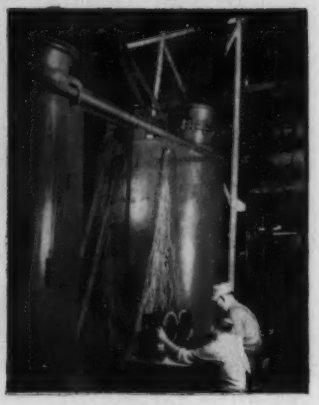
Exclusive, fully insulated potential device tap, unchanged dimensionally for 25 years, provides standard cable connection for any Westinghouse potential device. Does not have to be grounded —thus valuable bushing insulation is fully used at all times.

Extra interchangeability is achieved, in addition to the interchangeability with other manufacturers' bushings provided by ASA dimensions. Westinghouse ASA transformer bushings are designed to permit direct replacement of many older bushings. Westinghouse ASA circuit breaker bushings can be made interchangeable with flange and stud adapters.

Inventory savings are now possible: With Westinghouse ASA bushings as spares, bushing stocks can be reduced to a minimum. No adapters are required for most Westinghouse transformers.

Ask your Westinghouse representative about the ASA Type "O" bushings . . . or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-70880

YOU CAN BE SURE...IF IT'S **Westinghouse**



The superiority of the Westinghouse one-piece weather casing of wet-process porcelain is pointed out by Bob Rung, Transformer Components Sales Manager. Loaded in compression only, it provides the Type "O" bushing with exceptional mechanical strength.

Repeated testing of Type "O" bushings as part of high-voltage power circuit breaker development program proves the superior mechanical and electrical strength of these bushings has been maintained in achieving interchangeability, as provided by new ASA standards.

Photo by Morton

Niagara Mohawk Power Corp. Huntley Generating Station 230-kv Switchyard. Three-inch S.P.S. Alcoa Tubular Aluminum Bus with welded Alcoa Tee Connectors from bus to lightning arrestors.

ALCOA
RESEARCH

. . . development today for tomorrow's loads

HOW ALCOA BRINGS NEW ECONOMY TO MODERN SUBSTATIONS

ALCOA ALUMINUM BUS AND WELDED BUS FITTINGS: A NEW ERA IN SUBSTATION CONSTRUCTION COMES OF AGE

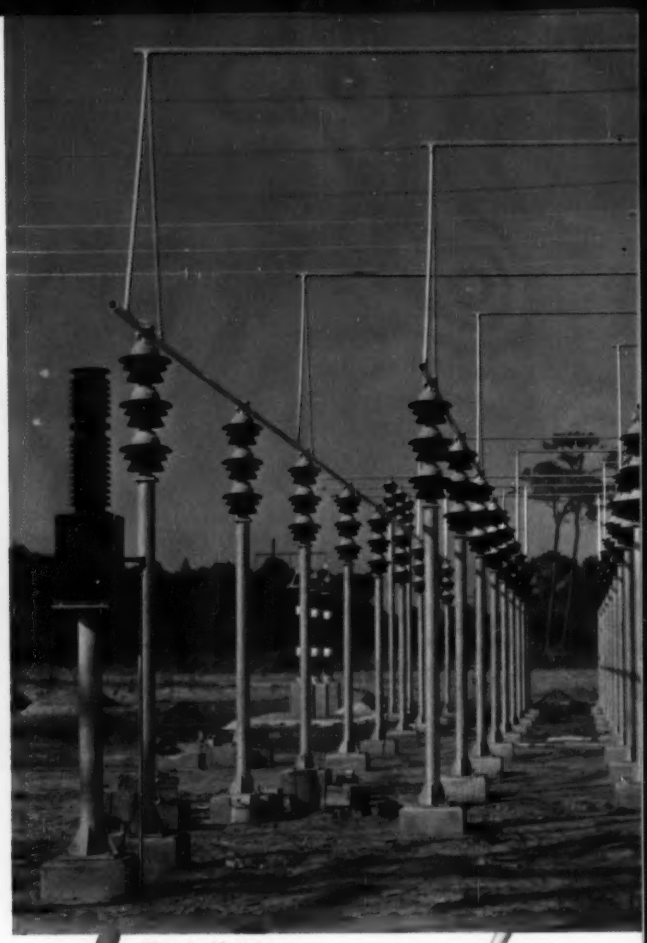


Photo by Morton

Florida Power & Light Co. Sanford Substation. Two and one-half inch S.P.S. Alcoa Tubular Aluminum Bus with welded Alcoa Vee and Angle Tee Connectors making "A" frame connections.

Many of the major developments in the evolution of the modern substation are results of research and development begun by Alcoa over half a century ago. Alcoa's experience with bus conductors, fittings and other substation equipment had its beginning in 1895 at Niagara Falls, New York. After studying an application in one of Alcoa's own plants, where flat aluminum bar was used to supply large amounts of power for electrolytic processes, Alcoa researchers were quick to recognize the tremendous economies it could offer utilities. Work began at once on such problems as temperature limitations, voltage drop, power losses and the effects of short circuit forces. Today, most of these problems have been solved. But work continues in order to meet challenges of changing design and demands for increased size and more economical construction prompted by the rapid growth of the electrical industry.

Typical of the results of this continuous program of research was the introduction by Alcoa of welded aluminum bus fittings. Much quicker and easier to install—particularly in those installations where many joints, taps and fittings are required—they also give a neat, compact appearance. They resist corrosion and provide added strength and durability that cut maintenance to a minimum. In the more than ten years since their first application, Alcoa welded aluminum bus fittings have saved utilities millions of dollars in construction and maintenance costs. With substations going up at a record pace, future savings should be even greater.

Credit for the development of welded aluminum bus fittings and many other innovations in substation construction and equipment must be attributed to the teamwork of Alcoa's research, electrical design and electrical operating people in cooperation with many farsighted customers who so willingly joined the pioneer ranks. Years of arduous research at Alcoa's Process Development Laboratories went into welding techniques; only then were Alcoa researchers satisfied that they had a product thoroughly sound—mechanically and electrically. Even now, after more than ten years of successful operation in the field, work continues with a single aim: to provide customers with still better products . . . and still greater economies.

Photo courtesy Public Service Electric and Gas Company

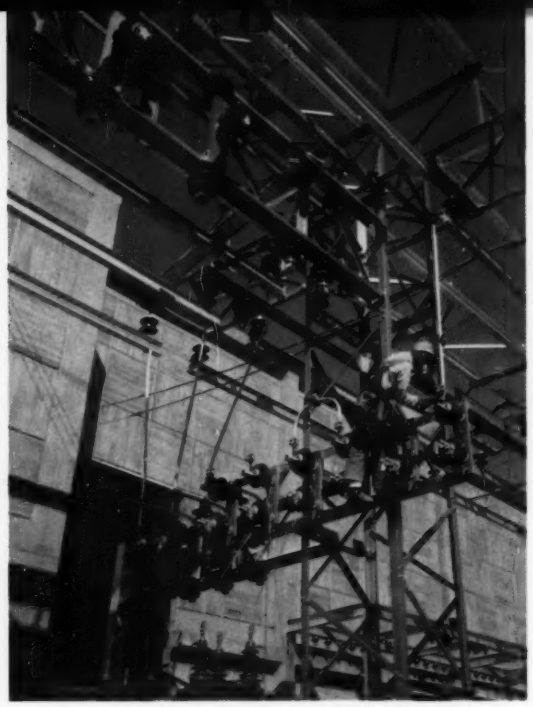
Public Service Electric and Gas Company Linden Generating Station. 18-kv load is transferred from isolated phase generator leads to 11-inch Alcoa Integral Web Channel Bus through welded flexible conductors.

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

ALCOA RESEARCH

. . . development today for tomorrow's loads

FURTHER ECONOMIES THROUGH MAINTENANCE REDUCTION AND FASTER INSTALLATION ARE GOALS OF ALCOA SUBSTATION RESEARCH



Aluminum Company of America. Wenatchee Plant Substation. Alcoa I-Beam suspended bus, with tubular bus taps mounted on aluminum structural members.

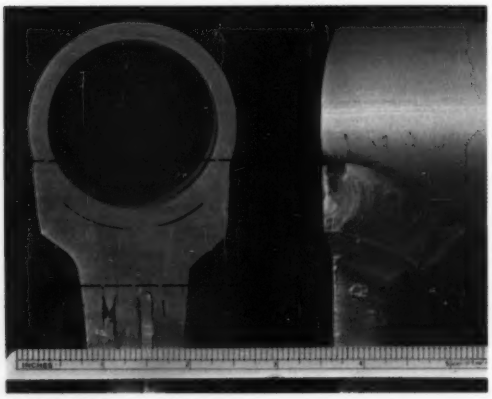
The results of Alcoa's continuous teamwork have already paid off with such major developments as integral web channel bus, universal angle bus, welded aluminum bus fittings and many other important innovations which have increased dependability and lowered costs. Today, Alcoa is still looking for better answers to substation problems in a number of important areas.

Maintenance Reduction—Aluminum substation structures never require painting, thus eliminating troublesome power interruptions for this routine chore. Welded connections are as maintenance-free as man knows how to make.

Faster Installation—Aluminum bus conductors and aluminum substation structural members both contribute measurable savings in construction time. The use of aluminum in the substation structure permits grounding of the structure base only, thus eliminating separate equipment grounds. Welded bus fittings may be assembled easily on the ground. The aluminum bus itself is light and easy to put in place.

As in the past, you can look to Alcoa for continued leadership in producing the most modern and dependable line of aluminum products available anywhere for the electrical industry.

Cross section of tap from tubular aluminum bus to stranded aluminum conductor. Weld is first made joining aluminum strands to inside socket of "top hat" connector. Then a fillet weld is made to join welded assembly to tubular bus.



Note integrity of welded areas.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM
ELECTRICAL CONDUCTORS AND ACCESSORIES
ALUMINUM COMPANY OF AMERICA

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings

36,000 BILLS PER DAY NOW

...and 50,000 later this year–

with Commonwealth Edison's

IBM 705

Almost two million customers . . . over 12 million bills yearly—that's part of Commonwealth Edison's enormous accounting task, and one reason why this great Midwest utility has pioneered in electronic data processing.

Today—with its 705 at work—Commonwealth in an eight hour period completely processes over 36,000 of the 1,335,000 customer accounts now billed by the computer. Ultimately, bills will be in the mail three days after meter readings—a saving of two full days over the pre-electronic methods!

What's more, Commonwealth gets many vital management reports—some never before possible—faster, more accurately than ever before.

Immediate plans for the use of the 705 include: addition of another 640,000 suburban accounts this year, plant accounting records, payroll, and further research studies, operations and engineering.

For more facts, call your local IBM representative, or write: PUBLIC UTILITIES DEPARTMENT A58-b, International Business Machines Corporation, 590 Madison Avenue, New York 22, New York.

IBM **DATA PROCESSING**

DATA PROCESSING
ELECTRIC TYPEWRITERS
TIME EQUIPMENT
MILITARY PRODUCTS

NOW...

dependable peaking

at $85

in blocks of

and reserve power

PER kw

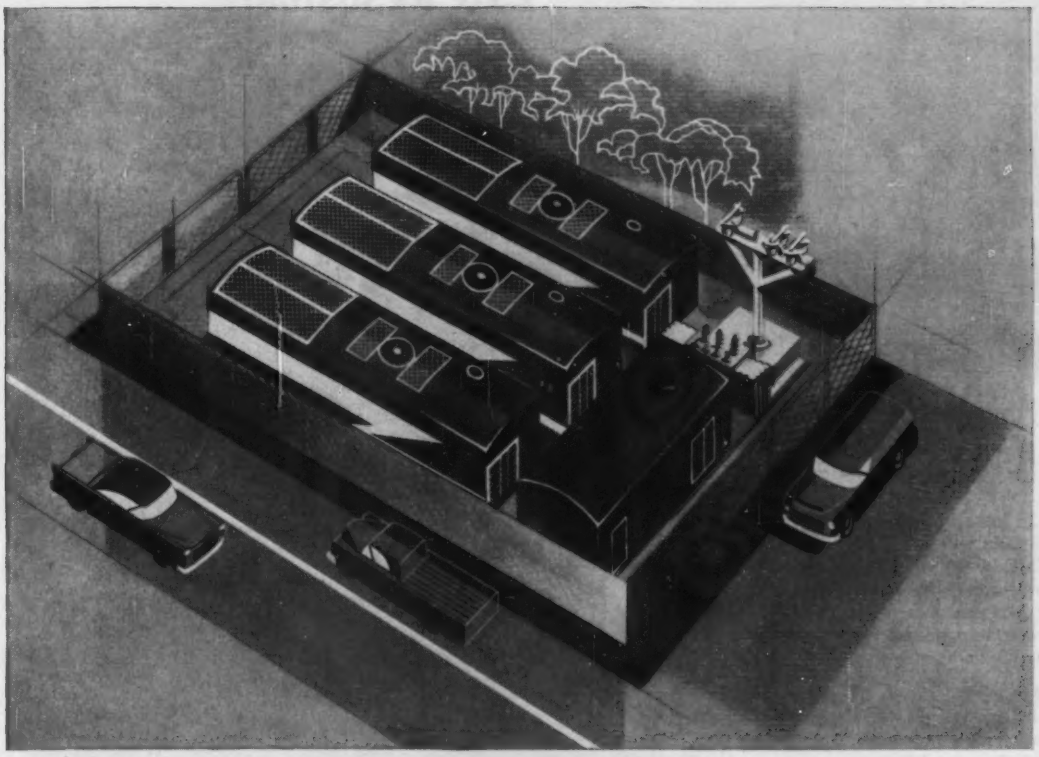
6000 kw

THE NEW→→

ELECTRO-MOTIVE
peaking and reserve

- ★ Full load from dead start in less than 90 seconds
- ★ Automatic unattended operation
- ★ Readily transportable to any location
- ★ Sub-station size
- ★ Sound deadened for quiet operation
- ★ Minimum installation costs

6000 kw plant

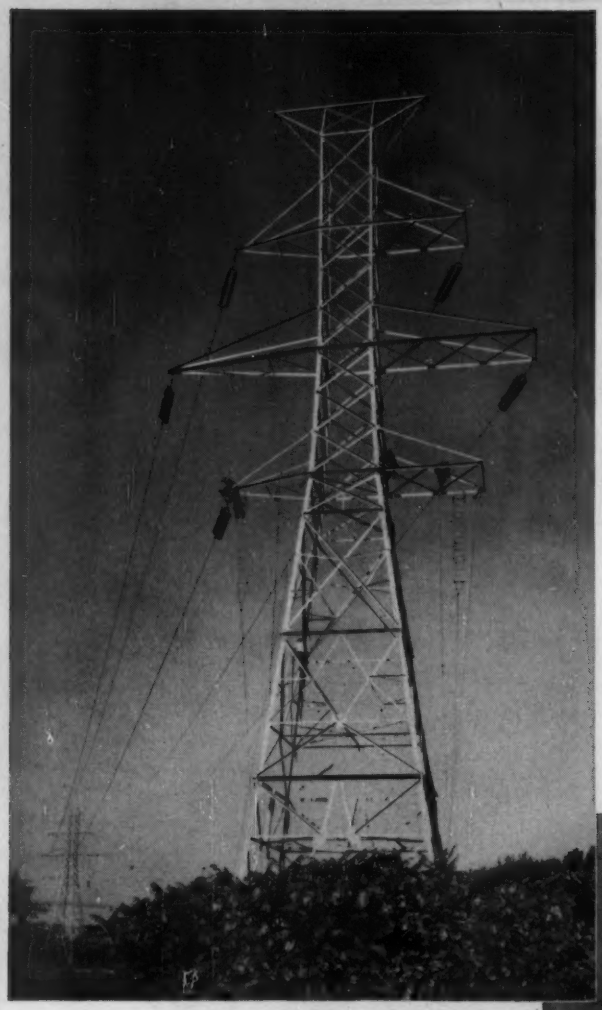


ELECTRO-MOTIVE DIVISION

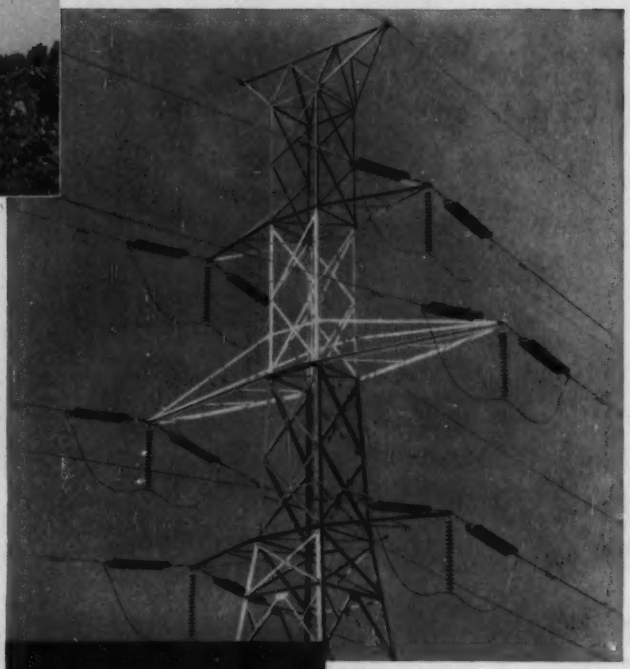
GENERAL MOTORS • LA GRANGE, ILLINOIS

Sales-engineering offices: Chicago, New York, St. Louis, San Francisco

In Canada: General Motors Diesel Limited, London, Ontario



MORE Lapp 25,000-lb. insulators for NIAGARA-MOHAWK 230-kv system



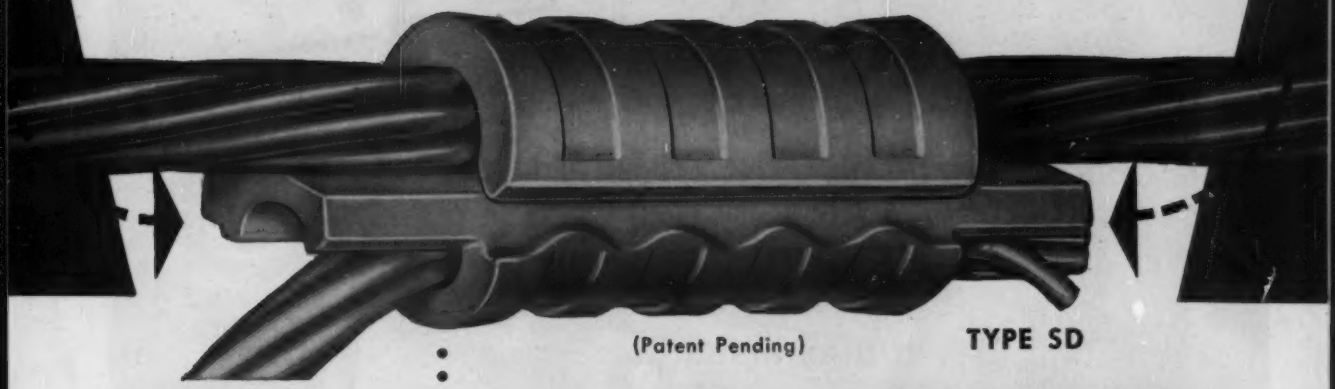
This new Huntley-Gardenville line on Niagara-Mohawk Corporation's system is 21 miles long, 230 kv, double circuit. Tower heights average 123 feet. Maximum span is 1250 feet, minimum span 400 feet. Conductor is 1192.5 MCM ACSR. Insulators used include Lapp No. 8200 (15,000-lb.) units in suspension strings; and Lapp No. 5960A (25,000-lb.) units, two-string yoked, for dead-ends, as shown here.

Niagara-Mohawk is one of many utilities whose service records on Lapp suspension insulators merit confidence. Lapp was pioneer in belief . . . and demonstration . . . that suspension insulators could combine electrical security, long life and consistent high strength. For your new construction at EHV . . . and regular transmission voltages . . . Lapp insulators will give you an extra margin of security in all these characteristics.

Lapp Insulator Co., Inc., Le Roy, N. Y.

Lapp

Exclusive New DRIP-GUARD SEPARATOR



(Patent Pending) TYPE SD

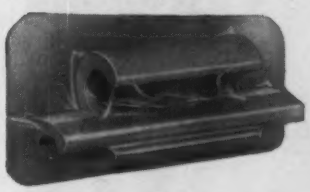
in BLACKBURN 6-Frame Tap Connector

- **Assures Separation of Conductors**
- **Provides Needed *Extra* Protection on Bi-Metallic Connections**

Type SF Recommended for Aluminum to Aluminum

This Blackburn 6-Frame Tap Connector assures complete separation and protection of the conductors. The Drip-Guard is unnecessary for this application.

Both Designs Available *Pre-Filled*

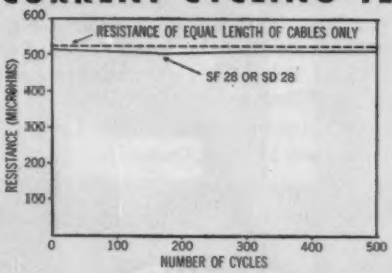


Type SD or SF may be ordered pre-filled with Blackburn's superior oxide-inhibiting compound, Contax. Pre-filling eliminates the possibility of an installation being completed without inhibitor.

Write for samples

LIVE BETTER ELECTRICALLY

CURRENT CYCLING TEST TELLS THE STORY



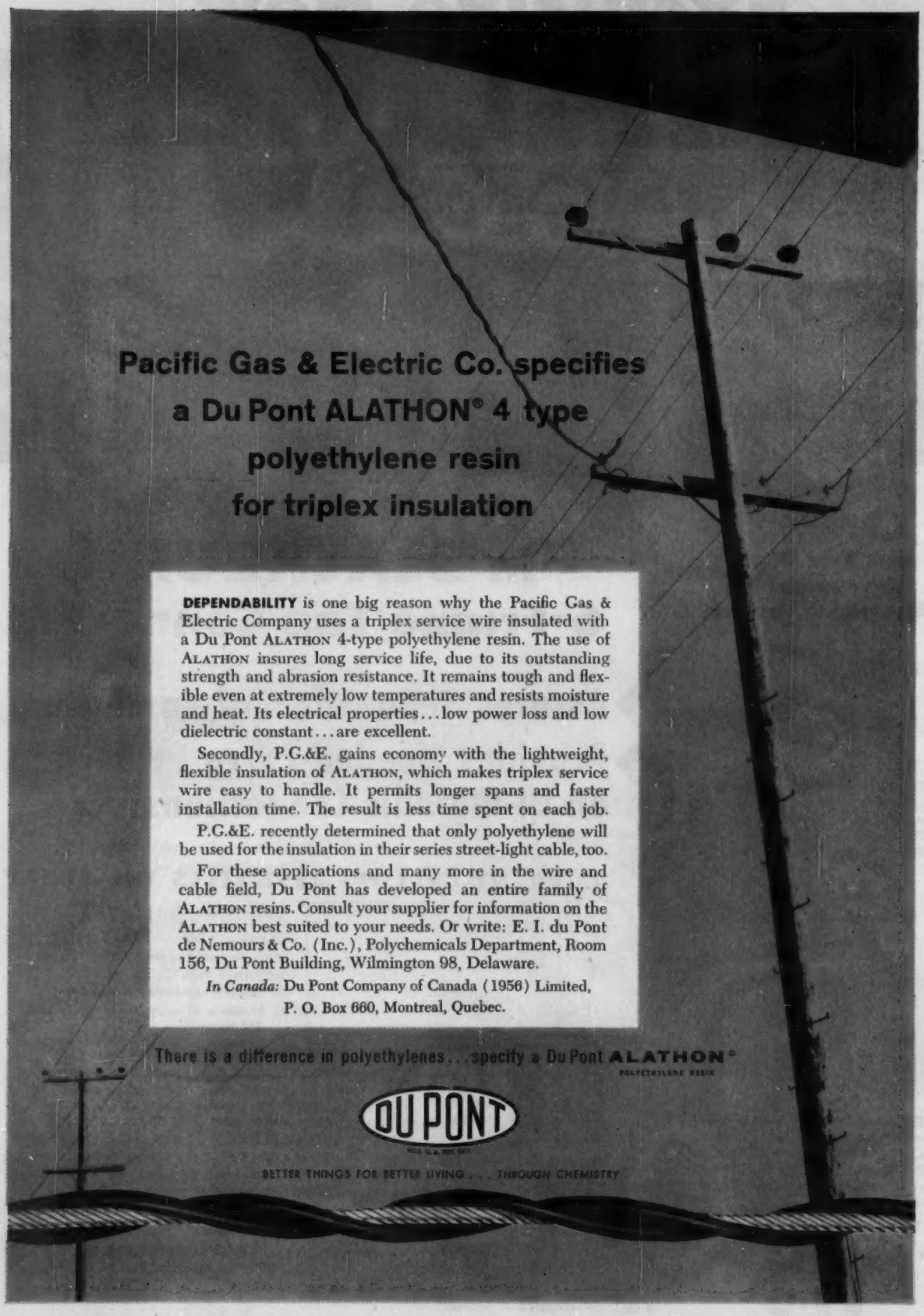
Current Cycling Test Conditions:

1. Cables: 4 Stranded Copper; 2 ACSR.
2. Cable operating temperature: 125° C.
3. Cycle: 2 hours "On", 1 hour "Off".
4. Length of connection: 24 inches.
5. Resistance of equivalent length of wire: 522 microhms.
6. Cables were wire-brushed, but no protective compound was used.
7. Curves represent an average of seven tests.

This rugged Blackburn design provides protection for conductors from both galvanic corrosion and physical damage. The Blackburn Drip-Guard Separator, plus the completely enclosed tap, prevents corrosion products from bridging the gap between the copper and aluminum conductors. Copper wire now can be used as main or tap without corrosion damage to the aluminum conductor.

In addition, the superior Blackburn design, which incorporates external channels parallel to the tap hole, assures uniform encirclement of both conductors when compressed.

Shot-blasted surfaces protected by an oxide-inhibiting film insure oxide-free connectors at jobsite.


Pacific Gas & Electric Co. specifies
a Du Pont ALATHON® 4 type
polyethylene resin
for triplex insulation
DEPENDABILITY is one big reason why the Pacific Gas & Electric Company uses a triplex service wire insulated with a Du Pont ALATHON 4-type polyethylene resin. The use of ALATHON insures long service life, due to its outstanding strength and abrasion resistance. It remains tough and flexible even at extremely low temperatures and resists moisture and heat. Its electrical properties... low power loss and low dielectric constant... are excellent.
Secondly, P.G.&E. gains economy with the lightweight, flexible insulation of ALATHON, which makes triplex service wire easy to handle. It permits longer spans and faster installation time. The result is less time spent on each job.
P.G.&E. recently determined that only polyethylene will be used for the insulation in their series street-light cable, too.
For these applications and many more in the wire and cable field, Du Pont has developed an entire family of ALATHON resins. Consult your supplier for information on the ALATHON best suited to your needs. Or write: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room 156, Du Pont Building, Wilmington 98, Delaware.
In Canada: Du Pont Company of Canada (1956) Limited,
P. O. Box 660, Montreal, Quebec.
There is a difference in polyethylenes... specify a Du Pont ALATHON®
POLYETHYLENE RESIN
DU PONT
BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

L-M Announces New Kyle® Metal-Enclosed Recloser

15 kv 110 kv BIL, Only $4,540

Here Is the Industry's First Three-Phase Standard Design Metal-Enclosed Recloser Switchgear.

TEAR OUT ALONG THIS LINE, AND FILE THIS INFORMATION.

Substantially Lower Cost

On a 15 kv 110 kv BIL unit, complete, savings in excess of 50% are possible for functional feeder protection. Installation costs are also less.

Major Insulation Porcelain-and-Air

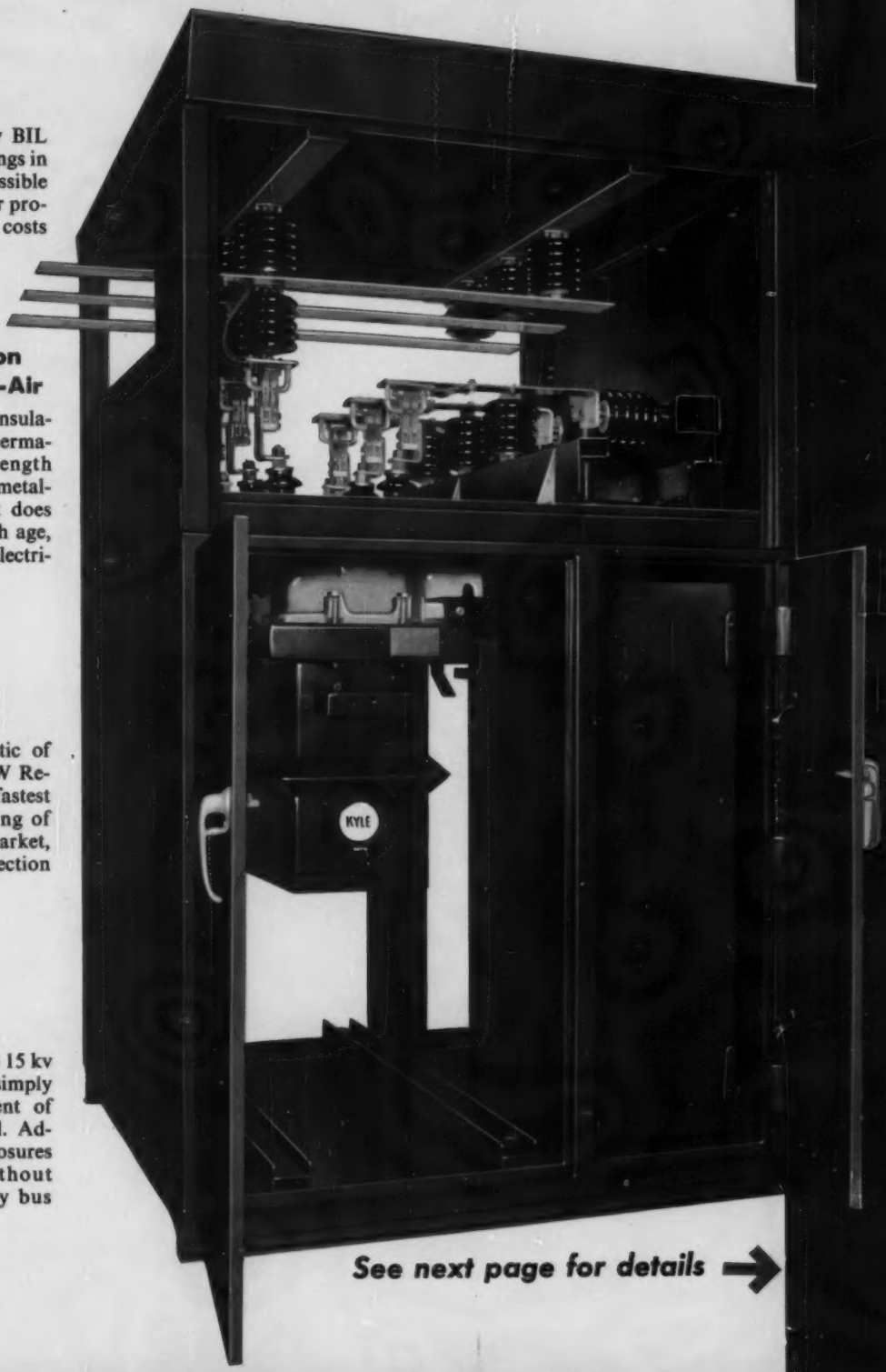
Porcelain-and-air insulation gives higher permanent electrical strength than conventional metal-clad insulation. It does not deteriorate with age, heat, moisture, or electrical stress.

Faster Fault Clearing Time

This is characteristic of Kyle Type R and W Reclosers, which give fastest three-phase clearing of any device on the market, giving better protection to conductors.

Provisions For Future

A change from 5 to 15 kv in functional unit simply requires replacement of recloser closing coil. Additional feeder enclosures can be added without tedious and costly bus joint insulation.



See next page for details ➔

1. Porcelain bushings—which, with air insulation, give high impulse and corona levels, and greater permanent creepage strength than phenolic insulation.

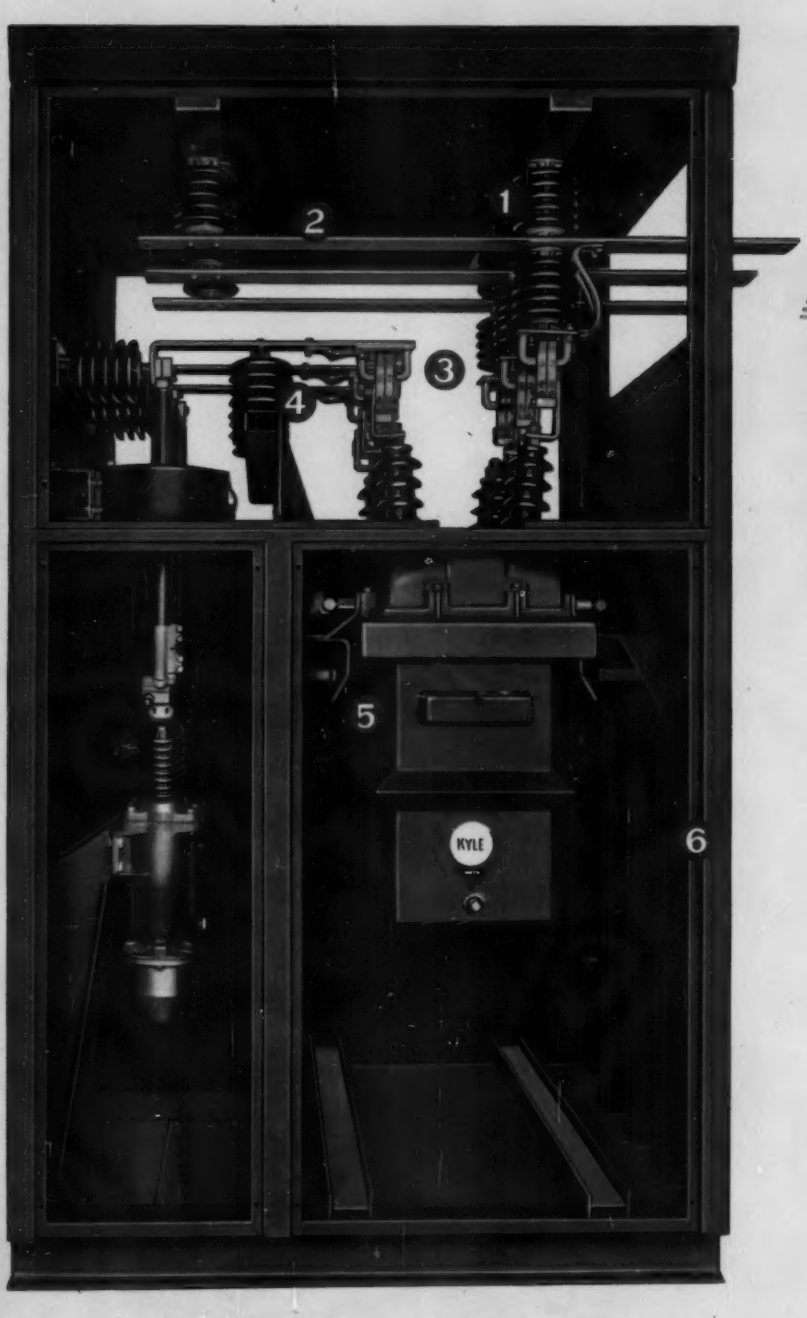
2. High location of main bus permits normal operation in flood areas. Units can operate in over 2 feet of water without damage or service interruption.

3. Recloser primary and secondary connections are automatically made as recloser is raised into operating position. Bushings on recloser have special flexible self-aligning disconnects.

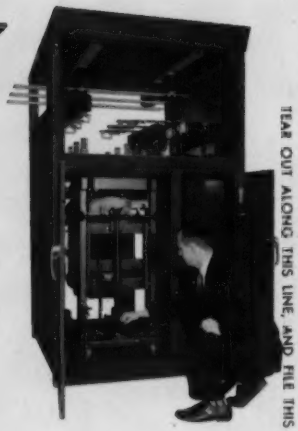
4. One of a number of troughs provided for low-voltage wiring.

5. Type W Recloser. Type R may also be used where loads are smaller, and changed to Type W when situation necessitates.

6. Compact—takes from 10 to 25% less ground area (and a smaller pad), and 25 to 35% less volume than comparable metal-clad equipment.

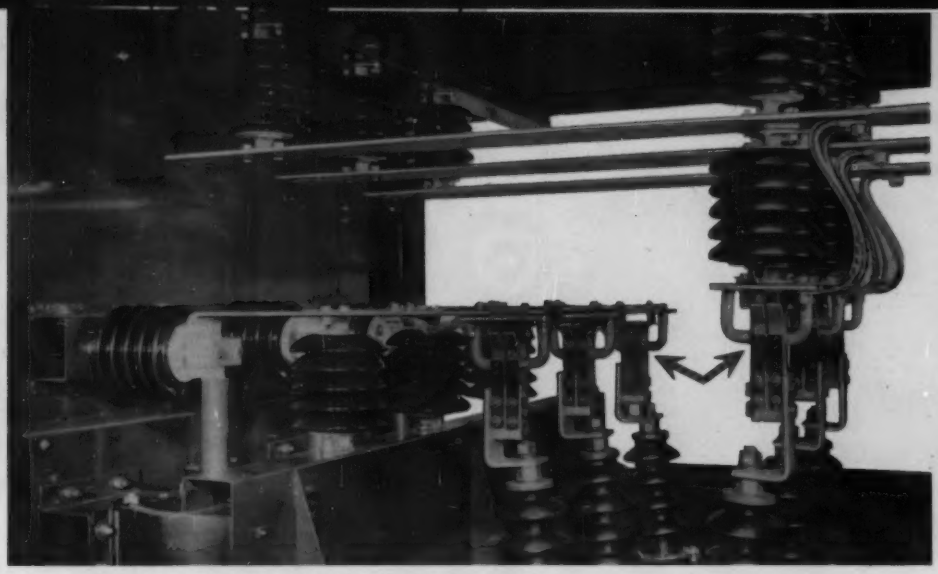


REAR VIEW of feeder unit with all panels removed.



HYDRAULIC LIFT TRUCK. Recloser is easily removed, or inserted and locked into operating position. Mechanical interlocks make it impossible to insert recloser into primary contacts unless recloser is in OPEN position.

TEAR OUT ALONG THIS LINE, AND FILE THIS INFORMATION.



DETAILS OF BUS COMPARTMENT showing current transformers and the ingenious arrangement for automatic connection of the recloser as it is raised into position. (Arrow)

New Kyle Metal-Enclosed Reclosers Offer Many Outstanding Features

Faster Clearing...Better Coordination...Lower Cost ...Porcelain-and-Air Major Insulation...Space Savings ...Provision for Future System Planning

FRANK McSTAY demonstrates accessibility of the meter compartment. The attractive low-line appearance of the Kyle enclosure makes it very desirable for urban areas. The unit is completely weatherized with phosphatized treatment, primer, and two coats of alkyd resin paint. Ventilators allow circulation of filtered air. Heaters prevent condensation of moisture.

by **FRANK W. McSTAY**, Product Manager
Kyle Switchgear, Line Material Industries

All of the well-known advantages of the Kyle Type W or Type R reclosers, plus simple, functional design, are now available in the new L-M metal-enclosed switchgear.

Cost As Low As $4,540

The units are simple and compact. They are highly efficient, and provide many advantages, at a substantially lower cost than that of the traditional metal-clad units. For example, the basic 15 kv 110 BIL feeder unit costs only $4,540.

Fastest Clearing Time

The reclosers themselves provide the fastest clearing, from fault initiation to arc extinction, of any device on the market. This high-speed clearing gives better protection to conductors against burndown and annealing, and thus assures better service continuity. Timing of the recloser is accomplished by self-contained time delay mechanisms which have indexed settings for specific time current characteristics. Kyle's usual wide choice of time current characteristics is available.

The units are quite flexible in many respects. There is a wide choice of optional equipment. Future expansion is easily handled, by either changing reclosers or adding additional feeder units. Space is provided in the auxiliary compartment for lightning protection. Many other features and options are available.

The units are compact, and installation is simple. They require less pad area, and therefore, less concrete. Fewer man-hours are required for installation, offering additional savings. Thus Kyle equipment offers savings you cannot afford to ignore.

Get This Bulletin and Details From The L-M Field Engineer

Or write Mr. McStay at Kyle Products Division, Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

LINE MATERIAL Industries
McGRAW-EDISON COMPANY

Kyle® Switchgear

McGRAW EDISON

TEAR OUT ALONG THIS LINE, AND FILE THIS INFORMATION.

Multiple feeder assembly with one auxiliary compartment at left end.

Many Optional Arrangements Available In New Kyle Metal-Enclosed Reclosers

by **LYLE McNULTY**
Application Engineer
and **CARL MERCIER**
Development Engineer
Kyle Switchgear
Line Material Industries

The new Kyle metal-enclosed switchgear is designed so that the basic unit is simple, functional, and extremely economical, offering substantial savings over traditional metal-clad.

But the design also makes possible a wide choice of variations, optional arrangements, and accessories to suit almost any requirements.

For simplicity, some of these variations are listed below. Complete details are available from the L-M Field Engineer, or by writing us at Kyle Products Division, Line Materials Industries, Milwaukee 1, Wisconsin. We will be glad to supply whatever information you wish, or to work out any arrangements you need.

The following variations and accessories are now available, or will be available shortly.

General

1. Choice of Kyle Type R or Type W Reclosers (ask for bulletins giving details).
2. 800, 1200, or 2000 ampere main bus section.
3. Roof bushing or throat circuit entrance to enclosure.
4. Formed weatherproof roof section for outdoor installation, or bolted panel roof section for vault application.
5. Window-type current transformers (110 kv BIL) or wound-type. Space permits installation of two window-type per phase, or one wound-type.
6. Observation windows may be located wherever desired.
7. Any metering or end devices which can be located on the metering panels.
8. Distribution or intermediate class lightning arresters if desired.

Auxiliary Enclosure

1. Gang-operated 800 or 1200-ampere blade-type disconnect, with or without 600-ampere load-current interrupters.
2. Fused disconnects.
3. Instrument potential transformers with current limiting fuses, and drawout type carriage for safety to operator.
4. Station control power transformer with current-limiting fused disconnect. Space will accommodate two 10 kva 14.4 kv distribution transformers and two fused disconnects.

Feeder Enclosure

1. Automatic shutters which close bushing ports when recloser is lowered.
2. Inclusion of any of the accessories available for the Types R and W Kyle Reclosers. (Bulletins available.)
3. Three-phase gang-operated pothead grounding switch.
4. Split bus for duplex operation.
5. Single-phase or three-phase potheads or condulet cable exit.

Let's Clear Up "Clearing Time"

The published time-current characteristics for Kyle oil circuit reclosers include the *total* time, from instant of fault initiation to the completion of arc extinction. This includes the complete fault sensing period, tripping time, and sufficient contact travel time for complete interruption.

Since the fault sensing and timing means is incorporated within the Kyle recloser, this recloser is independent of external devices, which themselves may add appreciable time to the operating time claimed for other devices.

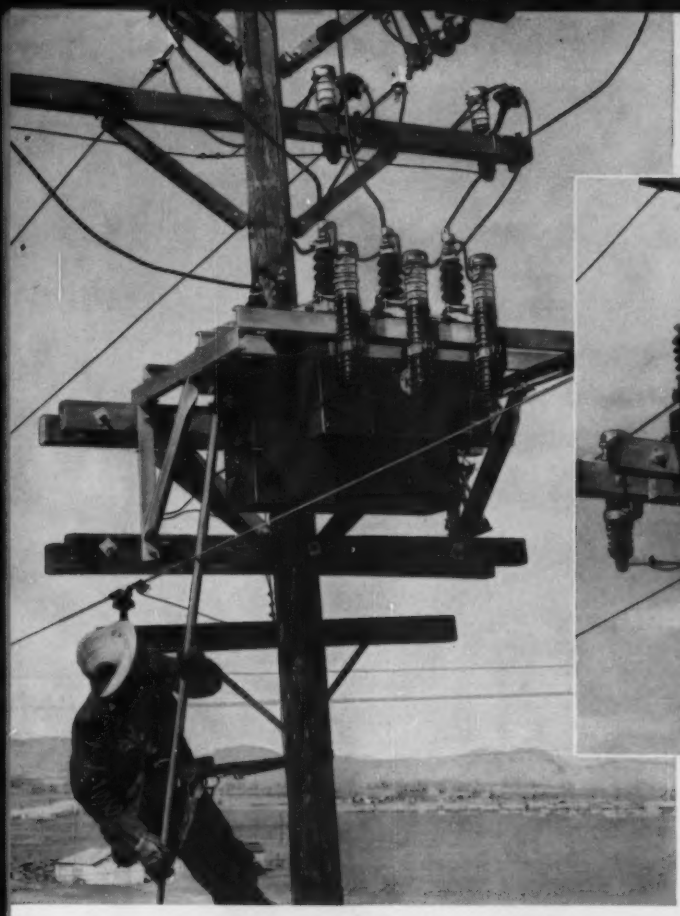
Thus the 2 or 2½ cycles in which Kyle reclosers clear faults is appreciably less time than that required by devices usually incorporated in metal-clad equipment. Therefore, Kyle switchgear gives much better protection to conductors, and much better insurance of service continuity.

340

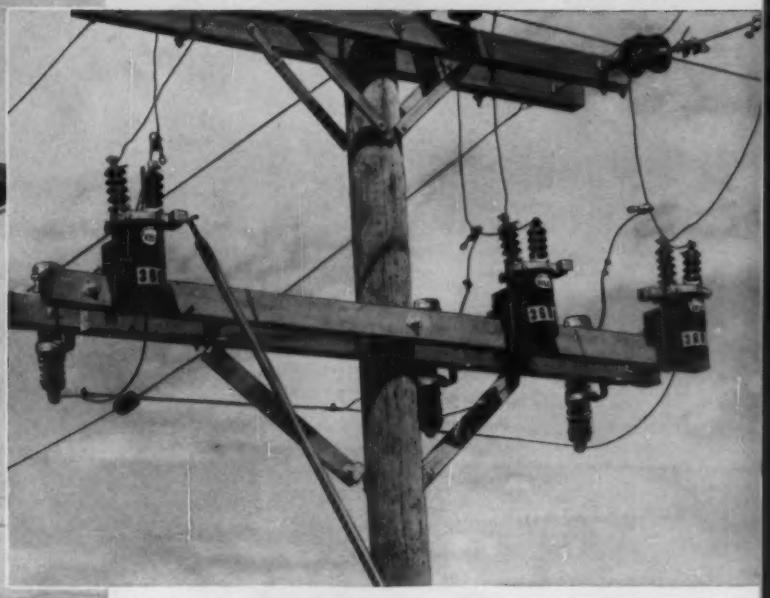
LINE MATERIAL Industries
McGRAW-EDISON COMPANY
Kyle® Switchgear

McGRAW EDISON

TEAR OUT ALONG THIS LINE, AND FILE THIS INFORMATION.



THREE-PHASE 185-ampere Kyle Type R recloser with 200-ampere ground tripping protects the main circuit from faults on a 3-phase branch line in Denver.



THREE 140-AMPERE single-phase Kyle sectionalizers protect the main feeder from faults on short branch lines, and also sectionalize areas behind reclosers. These are operated either by recloser or station breaker.

Report From Public Service Company of Colorado...

Standard Recloser Application Program Conserves Time For Utility's Engineers

Fundamental plan simplifies application of reclosers and sectionalizers; conserves engineering, record-keeping, and storekeeping time; gives better conductor protection.

A standard application plan for reclosers and sectionalizers offers many advantages. With a predetermined program, this equipment is selected and installed according to the plan, without any further engineering.

Basically the plan consists of selecting certain ratings of reclosers and sectionalizers to be applied to branches according to load, line length, and exposure. The plan automatically assures adequate protection against burndowns, gives better assurance of service continuity, and insures coordination.

Public Service Company of Colorado is an outstanding example of a utility with a fundamental protection plan. According to Messrs. Hayden, Martin, and Tilson, electrical engineers for P.S. Company, in the first year "savings in engineering time, record-keeping, and storekeeping have been so obvious as to warrant considerable enthusiasm. Also field experience so far has been most gratifying, because it has indicated that definite and concrete operating benefits have been and will continue to be enjoyed as a result of this plan."

This and other programs provide for complete flexibility. In the original program, any ratings and sequences that engineering prefers are selected. Thereafter the plan is applied automatically. The plan provides for switching or dividing load areas or feeders, and for taking care of increasing loads.

Ask Us For Details

Bulletins on Kyle Reclosers and a copy of a paper on the Colorado plan are available. We'll be glad to supply you with copies. Ask the L-M Field Engineer, or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: Canadian Line Materials, Ltd., Toronto 13, Ontario.

McGRAW EDISON

LINE MATERIAL Industries Kyle® Reclosers

McGRAW-EDISON COMPANY

337

Then he says: "Line Material is announcing **SRT** on June 23rd!"

Big deal! So I says: "George, there is a time and place for everything"...

Editorial Comment

June 9, 1958

Needed: A Decision On Higher Service Voltage

We need a decision on a standard for higher service voltage for high-use homes. The growth in residential use today and the mounting promotion of house heating to balance air conditioning load imply that further delay will endanger future economies.

Today electric house heating is served at 120/240 v by conventional distribution. But its 10-to-20-kv demands far exceed the per-home loads consumed in the economic studies which guide distribution design. Thus has emerged a compelling need to extend these studies to new horizons of heavy residential use.

Explorations into this area have been made by several distinguished distribution engineers who found savings through higher service voltage. Appropriate voltage levels have been proposed. Further study has convinced them that higher service voltage offers enough promise to merit trial installations.

The problem thus takes on a clarity that it lacked before. It is fortunate that this clarification has come in time to be considered by the growing number of utilities announcing plans to promote house heating—the type of load for which higher voltage offers economical service.

Today, as never before, electric utilities need agreement on higher voltage for residential service. This is the subject which the industry referred to committee nearly two years ago (EW, Aug. 6, 1956, p 61). Now the industry needs the committee's report to guide planning for tomorrow's all-electric homes.

Economies in Utility Operation

Electric utilities have earned acclaim for their proven ability to control the price of their product. Apparently no other industry has done as well in this respect. The record testifies to the efforts put forth by utility management and the cooperation it has received from manufacturers and consultants.

Great strides have been made but there is much more to be done. Right now, when rate increases are being sought extensively to maintain earnings, is a good time to look for more economies. The continuing inflationary trend adds urgency to the need for studies in this field.

Research offers promise of future savings on a wide front. But broader application of methods already in use on some systems provides many opportunities for immediate economies.

- Use of larger generating units and plants cuts capital costs and heat rates. Joint ownership can bring this economy to more systems.
- Coordinated efforts can reduce the cost of fuel and fuel transportation for small companies which, otherwise, are frequently at a serious disadvantage.
- Planning the system to facilitate expansion can gain economy in future additions of capacity.
- Reductions are possible in meter reading and testing expenses. A German utility expects to save 45% by reading its meters once a year. (EW, May 12, p 22). And several U. S. utilities expect to cut costs by random sampling.
- Mechanization of line work using smaller crews brings improved efficiency.

These and many other opportunities for economies have been widely publicized. Utility engineers will find ample reward for efforts to find and apply such methods in their own companies. Their unceasing search for better and more economical methods can enable the electric utility industry to preserve its high standards of efficiency indefinitely.

$5 Million EHV Research Project

- **General Electric to build 4½-mile EHV transmission line near Pittsfield, Mass. to operate at 460-750 kv**

- **To be energized first at 460-500 kv open-ended, line will later operate at 600-750 kv carrying 40,000 kva**

Details of a coordinated five-year research program designed to advance knowledge of extra high voltage transmission and to gain actual operating experience with it at voltages ranging from 460 to 750 kv were revealed by General Electric Co last week.

The $5 million program, called Project EHV, provides for a 4½ mile full-scale extra high voltage transmission line to be built next year near Pittsfield, Mass., home of GE's Power Transformer Department which is sponsoring the project.

Significance of Project EHV, as GE sees it, lies in helping to fill the need for new and wider technology in extra high voltage and in helping re-establish the U. S. as a world leader in extra high voltage.

Construction of the protoype transmission system will begin next spring and the line will be energized early in 1960. During its first year it will be operated as an open-ended line in the 460 to 500 kv range carrying charging current only. During this phase, studies will be made of corona, radio and TV interference, and mechanical line performance. Following these initial tests, conductor spacing will be increased and voltage raised to the 600 to 750 kv range.

In the summer of 1961 terminal equipment will be installed at the open end of the line. From then till the end of the five-year program the prototype EHV transmission system will be capable of carrying loads up to 40 Mva. Provision will be made to duplicate thermal effects on conductors, equivalent to those produced by loads exceeding 2,000 Mva. During this period Western Massachusetts Electric Co, on whose 115-kv system the test line will be installed, will operate the line at 600 to 750 kv for at least a year as an integral part of its power system.

Depending on further considerations the line may in 1963 be rebuilt and the voltage raised to 1,000 kv.

Besides Western Massachusetts Electric Co several other companies are participating in Project EHV. Stone & Webster Engineering Corp is designing the line, in collaboration with GE engineers, and is in charge of construction. Alcoa will furnish conductor and conductor accessories, and an as yet un-named steel manufacturer, the towers. An advisory council, representing the electric utility industry will help determine the preferred parameters and areas of study.

Dr. Pier A. Abetti, manager of systems research for GE's Power Transformer Department is in overall charge of Project EHV. Julius H. Hagenguth, manager of high voltage research is consulting engineer.

"The entire electrical power industry will benefit from this project," Dr. Abetti said in commenting on the significance of Project EHV. "We hope to be able to solve in advance many of the problems that could impede the progress of utilities in this field. The next higher step from the present 345 kv transmission will be in the order of 460 kv, which we should have operating in America in the next few years."

Dr. Abetti predicted that eventually the nation will have a coast to coast power grid comprising a firm network of transmission lines which will interconnect all major power generating areas of the country.

"Such a transcontinental grid can be achieved only with super voltages," Abetti asserted.

Detailed planning for tower and

Project EHV Timetable

December 1958	Detailed planning complete
Spring 1959	Start construction
Early 1960	Start operation as open-ended line. Voltage levels: 460 to 500 kv. Complete instrumentation and automatic data recording installed. Study of corona, radio interference, mechanical performance.
Early 1961	Change conductor spacing, install longer insulator strings, raise voltage to 600-750 kv range.
Summer 1961	Install terminal equipment at open end of line, completing loop with utility 115 kv line. EHV line to begin to carry loads up to 40 Mva at 600 to 750 kv; study thermal performance of conductors.
Jan-Dec 1962	EHV line to be operated on continuous basis by utility power dispatchers to gain EHV operating experience. Data recording and automatic monitoring via pilot wire telemetering continues. Data on tape for fast processing on 705 computer.
Jan 1963	Project halts for evaluation in light of advances in art. Decision made regarding increase to higher ac voltage involving conductor, tower, and terminal equipment changes.

Charted

line construction is already under way. The 300-ft-wide right-of-way has been obtained and design of power transformers, switchgear, and other electrical equipment is progressing to completion this year.

The line will be built over varied terrain including pasture, swamp land, and rocky woods along the Housatonic River at a relatively constant altitude of 1,000 ft. Spans between towers will range from 800 to 2,200 ft with the average about 1,500 ft. Largest angle in the line will be 30 deg.

Preliminary plans call for use of portal type towers (see picture) of structural steel, boxed girder construction 10 ft square in cross section. Highest tower uprights will be 160 ft, and the cross member 180 ft long, making these towers among the largest in the world.

Plans are to suspend bundle conductors from double insulator strings of 22 to 40 high strength (36,000

(*Continued on page 58*)

AT HEAD OF PROJECT EHV is Dr. Pier A. Abetti shown standing under model tower. Actual tower will be 160 ft high, 180 ft wide, have 20-ft insulator strings

Design Data and Preliminary Specifications for Project EHV*

GENERAL	
Line Designation	Project EHV
Voltage (nominal)	460 to 650 kv
Voltage (total range)	400 to 750 kv
Frequency	60 cycles
Length of line	4½ miles
Originates	Pittsfield, Mass.
Terminates	Lee, Mass.
Initial construction	1959
Normal rating per cct.	1500 Mva (line) 40,000 Kva (terminals)
STRUCTURES	
Material	Steel
Av. no. per mile	4
Type	Portal
No. circuits	1
CONDUCTORS	
Type	ACSR (2 to 4 per phase)
Gage	954 to 1431 MCM
Designed for	2,500 amps (max. circulating)
Phase configuration	Horizontal (triangular under consideration)
Phase separation	15 to 50 ft
Span, normal	1,500 ft
Span, maximum	2,200 ft
Min clear to ground	To meet NES Code
Min clearance to structures	16½ ft at 650 Kv
Line altitude	1,000 ft
INSULATION	
Basic impulse insulation level	About 2,600 Kv
Tangent structures	
Insulator type	High-strength (36,000 lb) suspension, ball-and-socket double string
Size & rating	10 x 5¾ in.; 50 Kv (wet)
No. units	26 to 40
Terminal	
Insulator type, size & rating, No. units, total rating	Same as tangent except 4 strings per phase
BIL of stations	2175 Kv
BIL of apparatus	1925 Kv (two steps down)
IMPULSE SURGE PROTECTION	
No. ground wires	2
Cone angle of protection	30 deg
Arrester rating	363 Kv for 460 Kv 513 Kv for 650 Kv

* Footnote: The above data are subject to revision according to suggestions and guidance from an advisory committee representing the electric utility industry, which will advise General Electric and the co-operating companies on the scope and research parameters of the five-year project.

Power Pooling Trend Gets Added Impetus

Go-ahead expected on plan for coordinated expansion of Iowa companies; Missouri Basin proposal is due in October

Five major Iowa utility companies have filed with the Federal Power Commission an agreement to pool electric generating facilities. The interconnection pact is expected to become effective by July 1, 1958.

The participating companies would equalize capacity as well as interchange firm, dump, and emergency power. According to an earlier program (EW, Oct. 28, 1957, p 44), savings of some $140 million could be realized between 1960-75 by means of coordinated expansion. This, however, was based on a group of seven participants.

The proposal involves Iowa Electric Light & Power Co, Iowa-Illinois Gas & Electric Co, Iowa Power & Light Co, Iowa Public Service Co, and Iowa Southern Utilities Co. They have a combined generating capacity of about 1,150 Mw. About 1,116 miles of transmission lines at 115 kv or higher already partially interconnect the five participants. They serve in 87 of the state's 99 counties and provide electricity to some 620,000 customers.

Main benefits of the pool will be reduced costs on installation of new generating capacity; better service reliability during emergencies; and economies of more flexible plant location, construction timing and unit size.

Savings of $110 million in plant construction costs and yearly operating savings of $10 million can be achieved in the next 14 years by utilities of the Eastern Missouri Basin Power Conference. This was the view of Hibbert Hill, Northern States Power Co's chief engineer and chairman of a committee investigating the plan. The committee will report on its study Oct. 1.

The plan involves 12 companies, 21 cooperatives, four federal agencies, and Nebraska power suppliers. All have pledged their cooperation.

The joint effort would help bring on the line 4.6 million kw needed to meet 1972 demands. This would require investment of more than $700 million. Besides this, some $800 million would be needed for transmission and distribution.

Cyrus G. Wright, Otter Tail Power Co president, told the group that enlightened self interest called for all to get on with the study.

Load, Capability Forecasts Take Only Slight Dip

Electric utilities have trimmed very little from their load and capability forecasts made last October, according to Edison Electric Institute's 23rd Semi-Annual Electric Power Survey.

Representing 98 percent of the capability and 99 percent of the energy output of U. S. electric power systems, the survey reveals:

• December peak load estimates for 1958 are up 11.7% over 1957's 106.9 million kw. In 1959, 1960 and 1961, peaks are up 8.1%, 7.0% and 6.8%, respectively.

Peak load forecasts in practically all instances are lower than corresponding forecasts of last October. The Dec., 1958 forecast is 2.5% below the previous forecast, while for 1959 and 1960 the forecasts have been reduced by about 2%.

While summer peak forecasts are also nearly all lower than last October, the decreases are less. The decreases are: 1.6% for 1958; 1.3% for 1959; and 1.1% for 1960.

Nevertheless, the 1958 summer peak load forecast of 115.7 million kw is 8.4% over 1957. Future growth is expected to be 9.0% in 1959, 7.7% in 1960, and 7.2% in 1961.

In comparing winter and summer peaks, the EEI report notes that summer peak loads in regions IV, V, VI, and VIII for 1958 and later are expected to be as high or higher than December peaks for the same years. Summer peak forecasts progressively approach the December peak forecasts during the years 1958 through 1961 when the summer peak comes within 1% of the December peak load.

• Generating capability in Dec., 1958 will be 16.2 million kw or 12.4% more than was available to meet last winter's peak. Further additions will boost capability 12.3 million kw (8.4%) in 1959; 11.2 million kw (7.0%) in 1960; and 8.9 million kw (5.2%) in 1961.

Present December capability forecasts as compared with those reported last October are 0.8%, 1.3% and 0.8% lower for the years 1958, 1959 and 1960, respectively. Forecast of summer capabilities are likewise slightly lower than earlier estimates. In both instances revisions stem from stretched-out schedules for bringing certain new generating units on the line.

• Gross margins resulting from new capability and peak load forecasts are generally higher than previously indicated. Winter gross margins for 1958, 1959, 1960 and 1961 are 22.9%, 23.2%, 23.3% and 21.4%, respectively. Summer margins for the same years are 20.3%, 23.0%, 22.6% and 21.1%.

• Total energy output forecasts for 1958 through 1960 have been reduced giving a lower rate of increase than previously indicated. However, even though already reduced, the survey committee felt compelled to point out that "the forecasts for 1958 and probably for 1959 are high" in light of present conditions.

Although output forecasts for 1958 and 1959 are 2.8% and 2.2% lower, respectively, than six months ago, 1958 output is expected to be up 8.0% and 1959 up 8.7%.

The Job Ahead for REA: III. NRECA Role Expands

Agency Administrator David Hamil hopes to see stronger systems obtain private financing. NRECA's Ellis contends the 'Wall Street' financiers would swallow up co-ops

HAMIL: Co-ops might form banks

Critics of the Rural Electrification Administration charge that today it should be clear to all that the need for a federal rural electrification program has ended. Continuation of federal loans, they maintain, can lead only to rural systems that will compete with private companies for commercial and industrial sales.

Here are some of the signs of REA's change through the years:

- About 78% of REA loans have gone for distribution lines, 21% has gone for G&T construction and the remaining 1% for financing the purchase of appliances, equipment and wiring by farmers.
- The average farm now consumes 300 kwhr monthly, contrasted to about 60 kwhr in 1940.
- About 50 borrowers have repaid their loans, and more than 750 are repaying loans ahead of schedule. Two loans have been foreclosed by REA, and five borrowers are delinquent by 30 days or more.
- The average rural co-op today has about 1,250 miles of line and serves about 3,500 customers.
- During 1957, for the first time, farmers accounted for less than half the rural power sales made by REA systems.

The present Administrator, David A. Hamil, who replaced Nelsen in 1956, has emphasized that REA will make loans to finance generating and transmission facilities only "where no adequate and dependable source of power is available," and "where the rates offered by existing power sources would result in higher cost of power to the consumers . . ."

Hamil hopes that, as these systems grow financially stronger, Congress will permit them to obtain private financing for their future construction. Thereby, the stronger systems will be able to drop from the REA loan program, while the newer, smaller and weaker systems will continue to borrow from the government. A proposed bill on this subject is dying in Congress this session for lack of a sponsor, however. Hamil also has suggested that the rural cooperatives might form their own banks—state or national—to finance future construction. He feels that the systems might be able to start such banks, possibly modeled on the federal land bank system, within six or seven years.

More G&T Facilities Needed: Ellis

Ellis and NRECA, however, oppose private financing, claiming that this would lead inevitably to the rural systems being swallowed up by "Wall Street" financiers, favorable to investor-owned power companies. He feels that federal loans will be needed on a growing scale to heavy up rural lines and to permit rural systems to build G&T facilities.

Ellis has been charged with trying to lead electric co-ops into a Federal power network. He responds that the co-ops' own G&T facilities and federal projects are the only guaranteed source of low-cost power for the future.

The National Rural Electric Cooperative Association was organized in March, 1942, in Washington, D. C., by ten men who had come to testify before a congressional subcommittee on alleged copper hoarding by several co-ops.

As set forth in its articles of incorporation, the NRECA aims:

- "To assist in the utilization of rural electric cooperatives for the most effective prosecution of" World War II, "and to assist such cooperatives with respect to their common problems in the post-war period."
- "To engage in the compilation and dissemination of information with respect to rural electrification and the furnishing of other services to rural electric cooperatives and others in connection with the coordination, advancement and development of rural electrification . . ."

In '37 former Administrator Carmody discussed the ned for a cooperative organization to collect and discuss technical information, and to develop a united policy in their dealings with the private companies. Robert B. Craig, an assistant to Carmody at that time, favored the organization of such a group so much that he promoted its creation on his nation-wide inspection trips.

Clyde T. Ellis, NRECA's executive manager, points out that the association is performing the same functions today as it did when it was first organized. Here are the services to member co-ops he lists:

Group insurance and pensions programs; "legislative representation" before Congress; various management aids, including institutes and a power-promotion program; a system of regional and national meetings; publication of "member education" data and a small, but expanding public information program; centralized purchases of equipment and supplies for member co-ops; and the right to use its symbol, "Willie Wiredhand."

Ellis points out that many of these services provided by NRECA were provided originally by REA, and the association set them up after

(*Continued on page* 126)

$5 Million EHV Research Project Charted (*Continued from page 55*)

lb) 10 x 5¾ in. disc insulators. The length of strings, conductor spacing, number of conductors in the bundle, and their configuration will be changed to suit various test requirements such as voltage level and phase arrangement. Conductor sizes in the range from 954 to 1,431 MCM will be studied in bundles of 2, 3 and 4 conductor per phase. For operation in the 600 to 750 kv range four conductors in a square bundle will be used.

Two overhead ground wires are planned, to be located on top of the cross member midway between the first and second, and second and third phases. All clearances will meet requirements of the National Electrical Code.

Project EHV will augment previous work in the field of extra high voltage transmission. However, in length of line, in its loading, and in the elaborate system for continuously recording data from some 200 instruments at several stations, this project differs from most previous efforts. Test data will be recorded in digital form for fast processing by Power Transformer Department's IBM 705 electronic data processing machine.

During the later phases of the tests, conductor temperature rise over ambient will be varied to simulate power system conditions—circulating currents of up to 2,500 amp will heat the bundled conductors to temperatures which would be reached under operating and overload conditions of future power systems.

After actual operating experience has been obtained at 600 to 750 kv the entire project will be re-evaluated and a decision made whether to raise the line to higher ac voltages, a step that would involve tower and conductor alteration, or to seek other areas of investigation.

FPC Turns Down Rates On Power Sold to TVA

The Federal Power Commission has disapproved a $3,950,000 annual contract, under which the Southeastern Power Administration has been selling power to the Tennessee Valley Authority for ten years, because SEPA's proposed rates do not return sufficient construction costs to the three multipurpose dams involved, as required by provisions of the Flood Control Act of 1944.

The three dams, Wolf Creek, Dale Hollow and Center Hill, have an installed capacity of 459,000 kw, all of which is sold to TVA.

SEPA based its proposed rates on the incremental cost of adding generating facilities at the three dams and on a 2% rate of return on U. S. Treasury bonds.

The FPC ruled that power rates from these dams must include their assigned amount of the total construction costs, as the generating facilities were added before the dams were completed. The FPC also pointed out that SEPA must include in its cost of service to TVA a 2½% interest rate.

SEPA is required by law to file a new rate schedule for FPC approval, although SEPA officials in Washington have no idea at present when a new schedule will be drawn up.

Frank Wilkes Succumbs at Hearing

WILKES: 'One of the strongest'

Frank M. Wilkes, chairman of the board of Southwestern Gas & Electric Co, collapsed and died while reading a statement before the House Interior Committee May 29. The 68-year old Shreveport, La., executive was testifying in opposition to the Trimble bill, which would alter the allocation of costs of hydro dams.

Described as "one of the strongest advocates of the private enterprise system in the U. S.," Wilkes appeared in good health prior to the meeting. A physician said Wilkes apparently had suffered a coronary thrombosis.

Roslyn-Cle Elum Area May Get Steam Plant

Supplies of coal in the Roslyn-Cle Elum area 100 miles southeast of Seattle are ample to supply a steam power plant, the Washington State Power Resources Advisory Committee was told recently by Dr Louis McCabe of Washington, D. C., and T. G. Gerow, Minneapolis, Minn., consultants.

The committee, working through the Kittitas County PUD of Ellensburg, is studying construction of a steam plant to provide peaking power to be used in conjunction with hydro power.

The McCabe-Gerow report confirms estimates previously given by the Northern Pacific Railway, operator of coal mines in the area.

PA's Swap Cost Cutting Ideas

Economy takes spotlight at Edison Electric Institute Purchasing and Stores meeting as members tell of cutting costs by:

- **Shifting to vendor stocking of material in local warehouses.**
- **Effectively controlling small purchases of materials.**
- **Trimming overhead expense of handling low-value, high-volume items.**
- **Selecting proper units of material issue.**
- **Leasing vehicles and equipment.**

Vendor stocking of material in local warehouses is gaining in popularity with utility purchasing people. Most feel the savings in investment and overhead costs outweigh any price adjustments made by manufacturers for the service. This and other money-saving ideas, including control of small purchases and leasing vehicles and equipment, were thoroughly examined at the annual meeting of Edison Electric Institute's Purchasing and Stores Committee meeting in Minneapolis on April 28-30.

The well-planned meeting was attended by 124 EEI committee members and 100 manufacturer's agents and representatives.

Vendor Stocking

Vendor stocking of material chopped Baltimore Gas & Electric's central warehouse and sub-storeroom stocks from three to less than one month's supply according to D. J. Fitzgerald.

In evaluating the savings to his company, Fitzgerald found that vendor stocking incurs no extra charge in purchase of major material and that only in the case of a few minor items is there any additional cost for the service. And even on those items, the additional cost was less than BG&E's cost would be if handled through its central warehouse and then broken into smaller lots for distribution to outlying storerooms.

As an indication of the potential savings Fitzgerald stated that vendor stocking of copper wire alone has reduced his inventory by approximately $120,000, thereby reducing inventory charges and saving substantial hauling charges from main storerooms to district storerooms.

In examining the effects of vendor stocking on manufacturer's and utility costs, Fitzgerald said, "There is no gainsaying the probability that at least some of the vendors incur additional costs in setting up local warehouses and furnishing extra delivery service on an LCL basis.

However, in many cases these warehouse facilities are incidental to other operations and do not bear full overheads and operating costs. It is also possible that distribution can be effected at lower costs by the vendor in conjunction with his normal delivery program than it can be done by the utility. Therefore, if and when these additional costs affect the vendors' overall costs to a point where he must raise his prices many utilities will still be indulging in an economic practice, and certainly, as long as prices are the same whether material is delivered only to central warehouses in bulk, or to district storerooms in smaller quantities, it does not seem like good business not to participate."

Setting Up Vendor's Stocks

- Canvass various vendors to determine if they are interested in setting up local warehouse stocks.
- Take competitive bids at approximately yearly intervals with the understanding that there is no obligation to a supplier who loses the business the following year.
- Notify the successful bidder of the working stocks to be maintained (generally an estimated three month supply).
- Notify vendor as early as possible of items to be discontinued so he can arrange for orderly disposition of these items.
- Issue weekly storeroom requisitions to vendors for delivery to warehouses within a week.
- Take bids and place yearly blanket orders at least three months before current order runs out so that if current vendor is unsuccessful bidder he can conveniently dispose of his local stock.

Small Purchases

Loose control over small purchases can represent many lost dollars, PA's were told by F. M. Reinhold of Connecticut Light & Power. While individually these purchases appear to be minor, in the aggregate they represent a sizeable expenditure, said Reinhold, pointing out that small purchases by CL&P amounted to almost $1 million or about 3% of total expenditures last year.

Administration and control of small purchases can be facilitated, added Reinhold, by proper and more complete use of storekeepers. "Many companies have a storekeeper in each district or plant operation . . . He should be affiliated with the purchasing department —usually under the supervision of a general storekeeper, who acts as liaison between the purchasing department and the field."

A well trained and supervised storekeeper in the field recognized as the right arm of the purchasing department makes it possible for purchasing to extend

its scope into all areas of material requirement and use, said Reinhold. Such a plan, he added, can also do a great deal to improve communications with the field—an area in which many purchasing people have left much to be desired.

In addition to properly controlling small purchases, Reinhold suggested that further savings will probably result from a substantial reduction in quantity of materials picked up on local blanket orders. This can be accomplished by:

1. Extensive standardization resulting in less pickups of odds and ends locally.
2. Checking items involved in small purchases locally. It may show that while each district requirements are small, in the aggregate, they may be considerable. Savings may be made by central stocking.

Controlling Small Purchases by Local Storekeepers

- Have purchasing department predetermine best local sources of materials for use in a given area.
- Have purchasing negotiate yearly, or more often if necessary, with vendors regarding prices and discounts.
- If prices are satisfactory purchasing should issue blanket orders for the year on such vendors for use by local storekeepers in obtaining small quantities of materials required.
- Place a monetary limitation (usually $50) on such blanket orders. Also specify type of materials covered.
- Have purchasing check invoices covering materials obtained.
- Where no blanket or local order exists, under emergency conditions the local storekeeper should be given authority to issue emergency orders. A confirming requisition should be forwarded to purchasing for review.

Units of Issue

Material and effort is unnecessarily wasted unless units of issue are established which enable using departments to make withdrawals from stock in quantities that satisfy accounting requirements according to W. McClelland of Consumers Power.

Noting that material units of issue is a controversial subject, McClelland made no specific recommendations but pointed out their importance in analysing plant and investment records without application of conversion factors or estimates of quantities involved.

One way to cut down on the number of units of issue, said McClelland is the practice of buying, storing and issuing pre-assembled units rather than many components. In advocating this practice McClelland pointed out that it is much easier for storekeepers to take back complete units rather than various miscellaneous parts if they are not used after original issue.

Going one step further on the packaging theme, McClelland advocated as much standardization as possible in the industry in order to effect economies, not only in stores and accounting, but also from a purchasing standpoint. It is certainly no secret, he said, that a vendor can mass produce a given item much cheaper than he can if making it only for a handful of companies.

Paper Work

Record keeping and the subsequent paper work involved were suggested as other areas for potential savings by speakers addressing purchasing agents and storekeepers.

• Adoption of a minor item (exempt stock) procedure, said W. H. Brueggemann of Wisconsin Electric Power, has resulted in substantial savings in the accounting department and in the storerooms by effecting a reduction in paper work formerly performed. Resulting savings were despite the fact that any such plan increases hazards of losses due to carelessness, overstocking, understocking or diversion of materials.

• Physical inventory periods are being extended for economy reasons according to information submitted to E. J. Martin of New Orleans Public Service. While policies and practices regarding physical inventories vary considerably, added Martin, most members agree they should not be taken more often than required.

In discussing inventory periods, Martin suggested that "Perhaps the relation of inventory adjustment to the total value of material issued could be used as a yardstick to determine the frequency of taking inventory; or perhaps this same yardstick could be used for determining frequency of inventories by classes of material."

Hints for Good Inventories

- Good housekeeping
- Planning of storage before receipt of material.
- Training of employees
- Prompt handling of paperwork
- Careful preparation
- Proper identification of materials and bins

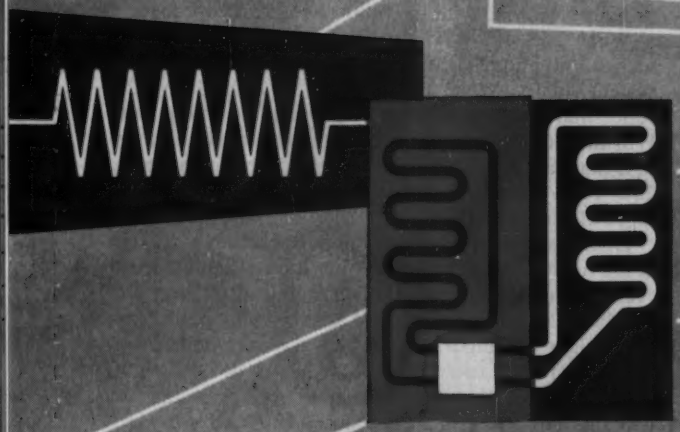
Equipment Leasing

Still another area of potential savings was outlined to PA's by J. D. Hogg of Cleveland Electric Illuminating talking on the controversial subject of equipment leasing. In outlining the financial type leasing arrangement Hogg cautioned that all leasing deals involve the consideration of many intangibles as well as the financial policies of the utility concerned.

In financial leasing, said Hogg, the leasing concern

(*Continued on page* 100)

A SPECIAL REPORT:



High-Use Homes: What Distribution Will They Need?

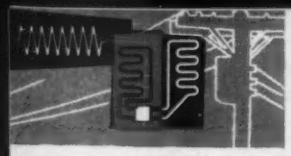
LEONARD M. OLMSTED
Managing
Technical Editor

Residential consumption upwards of 10,000 kwhr annually per home is the inevitable corollary of today's trend toward all-electric living. Acceptance of air conditioning in the South and the swing to electric house heating, most pronounced in low-rate areas like the Pacific Northwest, has boosted whole subdivisions to high average usages.

Distribution engineers are well aware that such loads were not contemplated in economic studies which defined today's system design. They are extending their studies and coming up with striking innovations.

Only three years ago, utility engineers were startled to hear R. F. Lawrence suggest serving high-use homes at voltage on the order of 265/460. This proposal was challenged by D. K. Blake who contended that utilities were too deeply committed at 120/240 v to justify a change. The debate continued for over a year. But as the participants brought in new data they drew closer to a common conclusion. Today, as revealed in this Special Report, they both advocate trial use of a higher voltage.

Meanwhile utilities have had to serve high-use homes at today's standard 120/240 v. W. H. Johnson analyzes distribution design for such service. And innovations adopted by three other utilities round out the report.



Service Voltage Boost

Actual Installations Needed

ROBERT F. LAWRENCE, Manager, Distribution Engineering Section, Westinghouse Electric Corp, East Pittsburgh, Pa.

Now is the time for building a developmental higher-secondary-voltage system, with autotransformers, in a group or groups of homes served by one or more utilities. Studies have given assurance that such a project would be economic and physically safe for customers, and the joint EEI-NEMA Committee on Utilization Voltages is on the way to recommending utilization-voltage standards. The thinking has been sufficiently thorough as a basis of decision for a developmental project.

There is little question that apparatus and appliance developments are practicable. Whatever is questionable can be proved out by such a project, and, in the process, any necessary approvals will be obtained. But the industry is already in a dilemma: Utilities having 265/460-v distribution are increasing, and present usage and purchases tend to fix standards. Yet 240/480-v, single-phase systems for high-use residential areas have many proponents.

The reason for higher secondary voltages in commercial areas is economic. Both user and utility save money. Studies and case histories put utility savings in the order of 10%. Building wiring savings are 15% or higher, varying with the ratio of 460 to 120-v load.

When 265/460-v nominal is the standard, the commercial situation is satisfied, but the 240-v residential system suffers. When the standard is 240/416 v, the residential situation is better, yet this question remains: Will utilities having 460-v commercial areas abide by that standard? Splitting the difference by going to a 254/440-v standard seems to combine the disadvantages of both alternatives.

Higher secondary voltage offers appreciable savings at the higher load densities in high use residential areas even when the scheme involves autotransformers for supplying lighting, outlets, and small appliances. Present designs of ranges and clothes dryers, modified for 240 v to ground, could be used as 3-wire devices, as at present, except that the utilization voltage would be 120 and 240 v to ground instead of 120/240 v 3-wire, 120 v to ground. The water heater, space heating equipment, and heat pump or central air conditioner would also require adaptation to 240 v to ground.

A transformer for obtaining 120 v is the practical solution to difficulties surrounding use of higher secondary voltage. Any proposal to design all appliances, including present 120-v designs, for 240 v to ground begs chaos in manufacturing, marketing, inventory, and consumer relations. Such changes offer neither economic nor improved-product incentive to customers.

An autotransformer is less expensive than a two-winding transformer and has proved successful in commercial buildings for stepping down from 265 to 120 v.

Early Decision Is Vital

D. K. BLAKE, Economic Consultant, User Industry Sales Department, General Electric Co, Schenectady, N. Y.

Professional builders since 1956 have been building homes by the tens, 100's, and 1,000's on single sites, these homes having air conditioning and other loads of 7 kva and upward. I have urged the industry to come to an early decision on whether it is going to use 240/480-v secondaries with autotransformers. The next few years may see the total volume of such housing increase very fast, and the industry could lose much opportunity through hesitancy. I am quite satisfied that the industry now understands the limited economic use of 3-phase secondary systems in future residential areas.

I have encouraged the use of 240/480-v secondaries, using autotransformers for lighting and small appliances if the industry can get the code cleared for 240 v to ground on fixed heavy-duty appliances and EEI-NEMA concurrence on range modifications. I'm willing to leave autotransformer size to local code authorities.

Any reduction in autotransformer cost, either through production methods or size reduction, widens the applicability of this system. But at the same time, the lower autotransformer costs go, the more difficult it becomes to justify subsequent introduction of 240-v incandescent lamps and plug-in appliances.

In 1954 I determined that the total retail sales of small 115-v plug-in appliances were five times the total distribution construction expenditures for 1953 for all customers, overhead and underground, of public and private companies. I realized then that the "tail was wagging the dog" in my earlier thinking, and it is now my view that foreign companies using the higher voltage are misleading themselves about their savings.

I think now that my 1923-to-1925 efforts and the recent efforts of others to obtain the introduction of 240-v lighting and small appliances are a lost cause. The largest savings shown by anyone are a disappointment to me. I thought earlier that they would be more substantial, but I had not actually studied them.

All studies—my own and others'—comparing 120/240-v with 240/480-v utilization, showed savings for the higher voltage. But none of them showed savings large enough to assure me that they would cover added cost of light and appliances for the higher voltage.

All studies, nevertheless, showed that the savings with large loads would be enough to pay for the use of

Urged for All-Electric Homes

Its use is permissible from a safety and code point of view as long as the neutral wire is grounded at the source. Assuming that up to 300 v to ground were permitted for a residential system, autotransformers could be applied as well as in commercial buildings.

In the developmental stage of a higher-secondary-voltage system, the autotransformer should have a rating slightly larger than 1 kva to obtain benefit from certain features of the customers' appliances. For instance, on one range model the 3,800-w, 236-v broil coil in the oven top is reconnected as an auxiliary bake coil to give 950 w at 118 v. This cycles "on" about 25% of the time after 9-min to heat up the oven.

The heater coil on a dryer model also can be reconnected to 118 v to obtain a quarter of the maximum wattage for gentle drying of synthetics. As both devices would be designed for 240 v to ground operation, 120 v between the two ungrounded wires of the autotransformer could be used for 120-v range-and-dryer load. thus balancing the autotransformer's load. This could not be done with a two-winding transformer.

Power company policy is to sell retail power to the residential consumer, whose problems are limited to adequate wiring and his own energy-consuming devices. It seems more logical to consider the autotransformer part of the utility service than part of the consumer's wiring. Furthermore, utility ownership encourages consumer use of electricity and eliminates customer problems of tradein when the rating of the unit is exceeded through the consumer increasing his 120-v load.

Energy consumption in today's home runs in excess of 3,000 kwhr annually. Each appliance has its own degree of saturation—note the low saturation of clothes dryers at 13.7%, ranges at 29.2%, water heaters at 17.4%, and negligible use of electric heating.

The addition of a range, clothes dryer, or water heater adds appreciably to the peak demand and kwhr consumption, but the most significant load is electric heating. Depending upon the geography, typical 15-min peak demands of 20 to 24 kw can occur with annual energy use of 20,000 to 30,000 kwhr. Heating and air conditioning by eelctricity can raise the "all-electric" home from 10,000 to 25,000 kwhr a year.

The use of a higher-secondary-voltage system would require slightly different metering than the 120/240-v, 3-wire service. The simplest form would be a single-element, two-wire meter ahead of the autotransformer. It could be adjusted to read zero consumption for zero load, i.e., it wouldn't register the no-load losses. Load losses in the autotransformer would have to be reconciled in some way, or a compensating device installed. Such a device could be within reasonable cost where it is mass produced. The alternative two-element meter on the load side of the autotransformer would cost more than twice as much as the two-wire meter.

While code problems may seem a deterrent, it appears that code changes can be made to permit a trial installation. A developmental higher-secondary-voltage installation can be one of the most worthwhile practical manufacturer-utility research projects.

---

an autotransformer supplying the lighting and small-appliance load at 120 v. For the record, I summarize my published studies on autotransformers, all figures covering cases where the utility can save enough to pay for autotransformers by using 240/480-v secondaries.

My first study, presented in May 1954, was based on 4-kv primary and 100-ft spans. It covered a range from 1.44 to 24 kva diversified transformer demand. It showed an average saving of $24.10 per customer. A 2-kva autotransformer cost of $49.50, including core and copper loss, was used. The tabulation showed:

Kva Demand	7.2	9.6	14.4	24
Saved/Customer by 240/480-v	$34.95	$45.80	$55.20	$78.30

Thus a 2-kva autotransformer at $49.50 could be justified for customers above 9.6 kva.

My next study, presented in Sept. 1955, was also based on 4-kv primary and 100-ft spans, and showed:

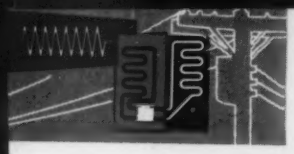
Kva Demand	7.2	9.6	14.4	24
Saved/Customer by 240/480 V	$41.12	$47.36	$47.54	$52.10

In this instance, in anticipation of quantity production, a range of auto transformer costs from $10 to $25, with 10 and 15-w core loss, was given. In these figures it is obvious that autotransformers are easily justified at $25 and 15 w. The autotransformer size was not specified, but a minimum of 1.5 kva was implicit.

My third study was presented in March and again in May 1956. My work took advantage of the excellent study and set of cost figures given by Hutchinson and Anderson in Oct. 1955. Their studies were based on 13.2-kv primaries and 200-ft spans. My figures were:

Transformer Kva Demand/Customer	Kwhr	13-Kv 200-Ft Spans	13-Kv 140-Ft Spans	4-Kv 140 Ft Spans
2.4	5,000	$25.66	$25.43	$20.75
2.88	6,000	34.24	24.14	18.66
3.84	8,000	41.88	35.63	25.78
4.8	10,000	54.89	31.62	20.92
7.2	15,000	44.27	30.05	17.55
9.6	20,000	84.18	61.16	45.16
14.4	30,000	148.38	77.40	76.90
24.0	50,000	121.80	126.51	109.57

I used Zimmerman's and Lokay's $28 for a 1-kva autotransformer and added $8 for core and copper losses to obtain a total of $36. Obviously the autotrans-



Service Voltage Boost Urged (Cont.)

Appliance Outlay A Factor

A. S. ANDERSON, Electrical Engineer, Ebasco Services Inc., New York, N. Y.

The effect of a higher service voltage on appliance costs is important today because the average home has from $1,000 to $4,000 or more invested in electric energy consuming equipment. The consumer's investment in wiring and equipment ranges from 10 to 40 times the outlay per customer of a utility company for distribution transformers, secondary wires, service drops, and meters.

Not only are the consumer's expenditures much greater, but what he buys has a shorter life than most supply equipment.

An increase in service voltage, involving the appliance design voltage, may boost the appliance's cost. That cost depends, of course, upon the relationship of the higher to the existing appliance design voltage. To provide the advantage of multiple and series connections of motor windings or resistance elements, the relationship must be 2 to 1, or 4 to1. Only such ratios permit a desirable interchangeability of components and, possibly, dual ratings for one line of equipment.

Ebasco's studies of this problem have led to the conclusion that ultimately all appliances, portable and fixed, along with lighting, should be served at a voltage to ground of 240 v nominal, and that the use of autotransformers for supplying 120-v appliances should be an interim expedient. Design voltages for resistance devices and fluorescent ballasts are 118 and 236 v but future designs could be based on 122 and 244 v.

EEI publication J8, "Utilization Voltage Standardization Recommendations," indicates voltage values to be recognized in equipment design, as follow:

	Preferred	Generally Experienced	Limits for Dependable Operation
Upper	125	127	130
Lower	110	107	105

But a shift upward in these ranges seems in order. As a tentative suggestion, and for illustration, a shift of 3¾ % is used hereafter. The resulting values of preferred utilization voltage on a double-voltage basis would then be 228 to 260 v.

Delta-connected transformers—including the single-phase, 3-wire, and the 3-phase, 4-wire arrangements—could work on the lower end of the range to afford a utilization voltage spread of 228/456 to 250/500 v. The wye connection could work on the upper end of the range to provide 236/408 to 260/450 v. Transformers of the same rating, with a 10% tap range, would satisfy requirements of both wye and delta secondary systems at present as well as at suggested voltage levels.

Homes generally should have little need for 3-phase motors. Commercial and small industrial consumers fed from a common primary generally need a service voltage between phase wire and grounded neutral that is the same as that of the residential consumer. This applies especially to hotels, motels, large apartment houses and, to a lesser extent, establishments using single-phase service for business office machines, medical equipment, cosmetic and cooking equipment.

A comparison of 265/460-v and 120/208-v wye systems shows considerable savings favoring the higher voltage systems for serving large spot loads. What is doubtful, however, is whether the 265/460-v system with autotransformers for 240-v equipment would be more economical than a 240/416-v system without transformers in an area where there are hotels, restaurants, hospitals, and office buildings.

If, at the double-voltage level, the limits of the utilization voltage cannot be shifted so that the $\sqrt{3}\ E_n$ is satisfactory for 3-phase motor operation, the next best solution is 3-phase motors rated at 416 as well as 440 v.

Some foreign countries have adopted 380, 400, and 416 v as the standard level for 3-phase service. Wider use of 416-v motors and wye systems in this country would provide an international market for the same design 3-phase motor for most applications.

Study Shows Savings At 240/480 v

A recent study by Ebasco of the comparative costs of various systems for serving residential areas includes customer wiring and appliance costs. Confined to new construction for serving new residential loads, this study excludes the changeover situation. Any rapid or wholesale conversion of present 120/240-v systems is neither practicable nor desirable.

At any rate, such conversion would take place gradually, as the real or economic lives of existing systems, utilization devices, and manufacturing facilities expire, or as the need for more utilization wiring capacity becomes urgent. The cost of changeover to a higher voltage would be much less than that of wiring replacement or circuit duplication. Possible savings per unit of existing structures are much greater than those attending new construction.

The cost study was limited to three customer groups, each consisting entirely of homes with the same connected load. The use of homogeneous groups simplified the study, but its final results should apply to heteroge-

Adapted from a paper read before Edison Electric Institute, Transmission & Distribution Committee, Feb. 12, 1958.

autotransformer and so specify a 3-kva size. My estimate for this size was $72.45. In that case the autotransformer is restricted to the 9.6-kva and above range with 200-ft spans, but still is applicable to above 9.6 kva for 140-ft spans, even with 4-kv primary.

"It is evident, therefore, that there will be some economic opportunity to use autotransformers," I wrote in this paper, "but their number is entirely too small to permit the economic marketing of 480-v appliances."

With this proviso, I have continued my encouragement of the use of 240/480-v secondaries, along with autotransformers.

neous groups as well. Loss costs and difference in investment were developed for each of nine systems, and the most economical transformer-secondary combinations selected for each system and load density.

Estimated cost of transformers, secondaries, services, autotransformers and their losses, and customer wiring costs are given in the table. An autotransformer, situated on the customer's premises, served 120-v incandescent lighting and convenience outlets. These systems should be regarded as stopgaps used while the necessary National Electric Code changes are being made and appliances are becoming available for higher voltage to ground.

The savings for the most economical system—the 240/480-v, single-phase, 3-wire with two-wire services —are $79, $101, and $138 per customer for customers with an undiversified peak demand of 5, 11, and 23 kva, respectively.

It was assumed in the study that the design voltage level would be doubled for portable appliances and that the present level would be retained for fixed appliances. On the latter, however, the ground point would be moved to effect a doubling of the voltage to ground. Costs are not expected to be higher on a long-range basis, and evidence points to lower net costs for lighting. Behind these conclusions are these probabilities:

1. Technological developments and improvements are likely to be facilitated by the higher voltage. This is especially true of home lighting, as the wider use of fluorescent lighting and of electroluminescent lighting can be predicted with assurance.

2. Utilization appliances, being comparatively short-lived, are subject to constant design changes. Thus double-voltage-to-ground design can be incorporated without a discernible effect in cost.

3. Present 120 and 240-v equipment may need redesign for greater safety. Consideration of 240-v to ground for all devices could spur these changes but should not be charged for them.

Higher voltage systems should be applied somewhat as follows:

240/480-v, single-phase, 3-wire overhead street mains for residential, commercial, and small industrial customers.

240/480-v, 3-phase, 4-wire overhead street mains or spot loads, for residential with 3-phase above 20 hp, commercial and small industrial, the latter two with the demand limits now used.

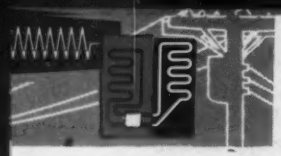
240/416-v, 3-phase, 4-wire spot loads for municipal, commercial, large apartment houses, and small industrial, the commercial and small industrial being above established demand limits.

240/416-v, 3-phase, 4-wire underground mains for business areas that now have 120/208-v systems.

265/460-v, or 254/440-v, 3-phase, 4-wire spot loads for large industrial loads and special large spot loads where the 120 or 240-v load is a small fraction of the total. The 254/440-v system is preferred.

Secondary System and House Wiring Cost

	Customer Undiversified Peak Demand		
	5 Kva	11 Kva	23 Kva
240/480 v, 1-phase, 3-wire, area			
Secondary and Service	102	153	253
House Wiring	542	566	605
Total	644	719	858
240/480 v, 1-phase, 3-wire, 2-way			
Secondary and Service	111	163	267
House Wiring	542	566	605
Total	653	729	872
254/440 v, 3-phase, 4-wire, area			
Secondary and Service	119	177	287
House Wiring	542	566	605
Total	661	743	892
254/440 v, 3-phase, 4-wire, 2-way			
Secondary and Service	140	201	327
House Wiring	542	566	605
Total	682	767	932
240/480 v, 1-phase, area with autos			
Secondary and Service	102	153	253
Auto Transformers	39	39	39
House Wiring	593	617	657
Total	734	809	949
240/480 v, 1-phase, 2-way with autos			
Secondary and Service	111	163	267
Auto Transformers	39	39	39
House Wiring	593	617	657
Total	743	819	963
120/240 v, 1-phase, 2-way			
Secondary and Service	133	193	318
House Wiring	590	627	678
Total	723	820	996
254/440 v, 3-phase, area with autos			
Secondary and Service	119	177	287
Auto Transformers	39	39	39
House Wiring	593	617	657
Total	751	833	983
254/440 v, 3-phase, 2-way with autos			
Secondary and Service	140	201	327
Auto Transformers	39	39	39
House Wiring	593	617	657
Total	772	857	1023



System Design Stressed for

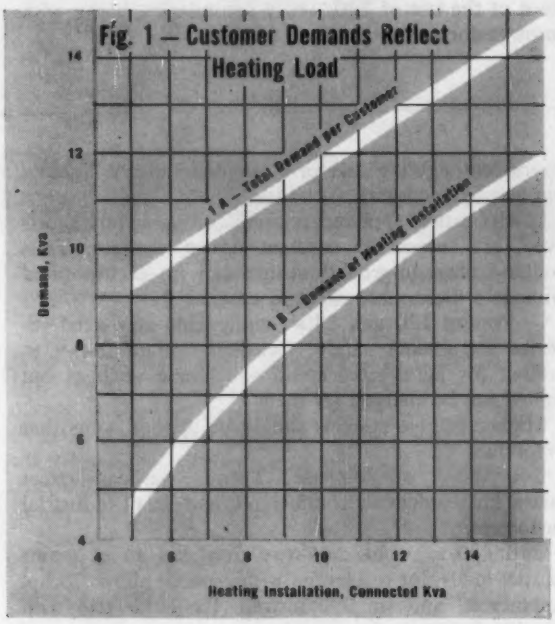


Fig. 1 — Customer Demands Reflect Heating Load
1 A — Total Demand per Customer
1 B — Demand of Heating Installation
Demand, Kva
Heating Installation, Connected Kva

WAYNE H. JOHNSON, Head, Distribution Engineering Section, American Electric Power Service Corp, New York, N. Y.

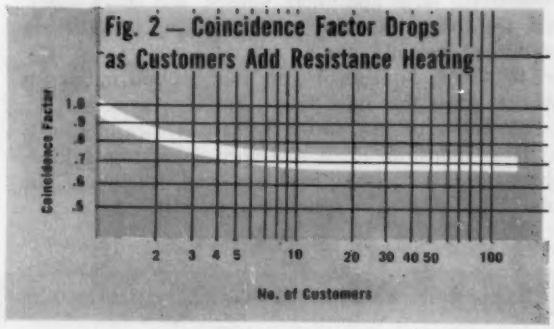
Mechanical system design and the proper primary and secondary voltages are essential for adequate service from an overhead distribution system to electric space heating loads. Secondary voltages for such service could be single-phase 120/240 v or 240/480 v, or 3-phase. These factors are cardinal in providing the most economical and reliable system, and only a good job obviates service interruptions and inadequate voltage, important hindrances to future electric heating promotion.

Secondary voltages higher than 120/240 v for residential services have been explored, but the complications are many, and no real agreements have been reached among utilities themselves, or among utility companies, manufacturers, consumer groups, and code authorities. The American Electric Power System is not serving residential customers at the so-called higher secondary voltage, but expects to continue to explore and carefully study all aspects of the problem.

120/240-V Service Found Adequate

In its studies of single-phase vs 3-phase service, AEP found that even the house of the future can be served adequately and economically at 120/240 v single-phase, and that there is no apparent reason for 3-phase service for the home of 20 to 30-kw demand. And distribution costs favor single-phase. Studies early in the development of the heat pump showed that costs for providing 120/208-v, 3-wire, 2-phase service far exceed those of single-phase, 120/240 v. Moreover, it would have required use of a 120-deg motor which had not yet been developed.

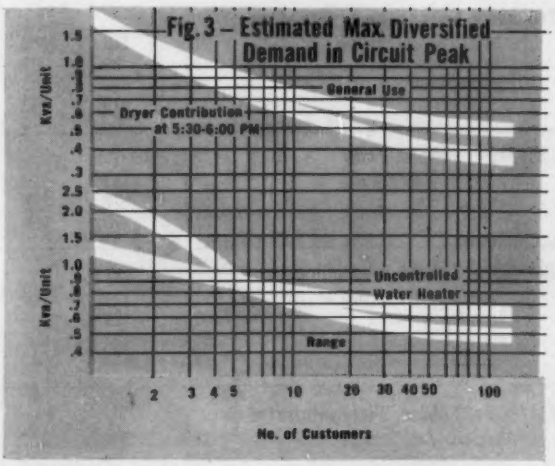
Connected space heating loads vary from 5 to 15 kw for small and medium-size homes and 20 to 30 kw for larger ones. Usually such a customer has an electric range, water heater, clothes dryer, and miscellaneous portable appliances. The ratio of this total demand to the installed heating load approaches 1 as the heating load increases to about 13 kva. Above that load, the ratio is less than 1.



Mid-day Falloff Aids Heating Diversity

Fig 1-A shows typical ratios between connected heating load and actual demand, and Fig 1-B, heating use within the house estimated from curve 1-A and Fig 3. A typical daily load curve of the space heating in a completely electrically equipped home, including heating, during the coldest day, shows 7 to 8 AM peak produced by the heating and a lesser peak at 6 PM from combined heating and other loads. The 7 to 8 AM peak is usually coincident with the coldest temperature period of the day.

As temperature rises the heating demand falls to a daytime minimum at about 3 to 4 PM and again in-



Serving Electrically-Heated Homes

Table I — Estimated Construction Costs per Customer for Electric Service to 230 Residences of 4 Types (With Street Lighting)

CUSTOMER LOAD	Minimum Use 1.5 Kva		Medium Use 6.0 Kva		High Use 12.0 Kva		Full Use 20.0 Kva	
CONSTRUCTION	Front Lot	Rear Lot	Front Lot	Rear Lot	Front Lot	Rear Lot	Front Lot	Rear Lot
4 KV O.H. $	90	94	127	133	177	178	299	289
4 KV U.G. $	387	290	412	332	588	472	914	774
Ratio U.G./O.H.	4.30	3.09	3.24	2.50	3.32	2.65	3.05	2.68
12 KV O.H. $	94	98	137	144	195	194	336	328
12 KV U.G. $	—	—	434	349	703	561	859	732
Ratio U.G./O.H.	—	—	3.16	2.42	3.60	2.89	2.56	2.23

Secondary 120-240 volt — Maximum Voltage Drop — 3% Transformer to Customer Switch Terminals. Cost of Street Lighting Construction Per Customer is; O.H. Front Lot $13/Customer, O.H. Rear Lot $23/Customer, U.G. Front Lot $22/Customer, U.G. Rear Lot $32/Customer.

creases due to the heating and other load at 6 PM. Fig. 2 gives a coincidence-factor curve for space-heated homes, an important part of the curve showing what happens in the first four or five homes. There is no material change for more homes. The first part of the curve is important in estimating designs of a secondary distribution system to accommodate the newly heated home in an existing area, or for groups of new homes, all with electric heating. Quick estimates of the distribution system for a complete residential subdivision with space heating may be made from the coincident-factor curve and the ratios in Fig 1-A.

Tests of the 30-min load characteristics of groups of heating customers show that about 85% of the individual customer's heating demand is recorded during the evening peak and close to 100% at the morning peak. The customer's other load contributes about 65% of the maximum morning demand and about 100% in the evening. Accordingly, morning and evening peaks must be checked in determining the maximum facilities for serving a system on which heating is being added.

High Heating Saturation Makes Morning Peak

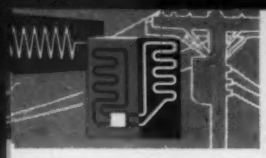
At about 30 to 40% saturation of heating customers, morning and evening peaks are about equal, but higher saturations make the morning peak higher so that morning load may control transformer and secondary design. A review of 30-min demands and tests on various appliances and general loads, as referred to the time of the general residential peak (5:30 to 6:00 PM), are shown in Fig 3. A fairly accurate estimate of the sizes of transformer, secondary, and service drop can be made from these curves in combination with Fig 1-B and 2.

Economical design and operation of transformers, secondaries, and services require their selection for providing adequate voltage to the customer's switch, along with a reasonable future capability for load growth. Voltage-drop limitations, assuring adequate voltage to the customer's switch, may be reasonably set at 3% in the transformer and 3% in the secondary and service connection. In a newly designed system, transformers and secondaries should be combined to afford the least annual cost per kva of initial load served with about 30 to 50% allowance for load growth. The economies of any set combination for serving a fixed load, while useful as a guide, should not be a rigid rule rigidly followed, especially for the service of growing loads.

The most economical operation range for distribution transformers, whose average impedance is 2½%, appears to be from about 85 to 145% load. Above 145% the voltage drop through the transformer sometimes becomes excessive, and usually the next larger size unit is more economical. Good judgment of future loads is important in selecting transformer sizes. To furnish adequate voltage to heating customers, initial design voltage-drop limitations usually should be less than 3% for secondary connections between transformer terminals and the customer's service switch. The estimated voltage drop in the secondary (Table II), excluding the service drop, would be 2.34% for 1/0 ACSR open wire with the neutral in top position on racks. This size is usual for general loading, and the 2.34% drop, combined with that in the service, should not much exceed the secondary connection limitations. Loads for secondary calculations are converted from 30 to 15-min demand by multiplying by 1.15.

Service Cable Selected to Match Load

Minimum size service drop cable from the pole to house is No. 4 aluminum, 3-conductor PE SD cable. A customer with an electric range, water heater, and dryer, as seen in Fig 3, has an individual maximum demand of about 7 kva. The voltage drop in a 100-ft service connection (75 ft of SD cable and 25 ft of No. 2 SE cable) would be 1% for this load. The most



System Design Stressed (Cont.)

economical aluminum services determined by cost of losses plus annual charges for various loads show No. 4 for loads up to 11 kva, No. 2 for loads above 11 through 16 kva, and 1/0 for loads above 16 through 20 kva. These can be used when the customer is served from a transformer pole. But when secondaries are involved use should be governed by the voltage drop limitation. In combination with secondaries, No. 4 should be used for loads through 8 kva, No. 2 for loads above 8 through 11 kva, 1/0 for loads above 11 through 14 kva, and 2/0 for loads above 14 through 20 kva. The 14-kva customers need 2/0 S.D. cable to allow for future load growth. The 10-kva heating customer can use No. 2.

Voltage Drop Controls Secondary Design

Having a 2/0 service, customer No. 6 (Table II) would have .68% voltage drop in his service, his total secondary connection voltage drop being 3.02%, only slightly above the design limitation. In this system the addition of two heating customers uses the secondary capability fully. Appreciable new load in the way of additional house heating can be served only by services taken off the transformer pole. This load data is usable also for designing a system such as is shown in Fig 4. This diagram reveals the most economical combinations of transformer secondary and services for supplying a small subdivision where space-heating-customer saturation is 42%. Transformer and secondary connection voltage-drop limitations are not exceeded for 130 to 150% of initial loads.

Recent construction cost estimates for serving 230 customers with residential-type underground systems indicate that at 20kva load per customer costs are less when primaries are 7.2/12.5 kv. This assumes that the primary source is available in adequate capacity and supplying satisfactory voltage regulation adjacent to the area to be served. Table I gives construction costs per lot.

For estimating designs for the low-voltage distribution system, test data has been supplied by Verlin J. Warnock, Indiana & Michigan Electric Co, Fort Wayne, Ind. AEP Service Corp's G. E. Rohr, A. J. Samuelson, and W. E. Mekolites did important work in developing relative cost data on overhead vs underground residential systems.

Space heating's heavy residential demands definitely influence the primary voltage serving an area. On a nominal 120-v system the initial maximum primary circuit voltage drops on radial feeders are usually designed to be not much more than 3% from a regulated station bus where the controlled voltage is usually 124 to 126 v equivalent. Maximum primary voltages at full load of 127 v equivalent are acceptable. This provides for reasonable load growth on the primary circuit before facilities are required to improve voltage.

Primary Capacity Boosted by Converting to 12 Kv

Often these limitations cannot be met by 4-kv systems without very costly additions, and conversion to higher primary voltage is often indicated for present and future loads. Several areas were converted from 4 to 12

Table II — An example of an estimate where heating customers are to be added to an existing system and where only electrical energy is available for cooking follows:

CONNECTED LOAD DATA

Items	Customer Nos.
House Heating	#1-10 kva, #6-14 kva
Ranges	All but #5 and #12
Water Heaters	All but #2, #3, #5 and #9
Dryers	At #1, #5, #6, #8 and #11

ESTIMATE OF TRANSFORMER LOAD

1. House Heating Load	Morning Peak	Evening Peak
Customer #1	8.7 kva	8.7 x .85 = 7.4 kva
Customer #6	11.1 kva	11.1 x .85 = 9.45 kva
	19.8 kva	16.85 kva
Group 19.8 x .82 =	16.26 kva	16.85 x .82 = 13.8 kva

2. Other Loads		
10 Ranges @ .70	= 7.00 kva	
8 Water Heaters @ .77	= 6.16 kva	This is the average contribution of 5 dryers to the evening peak.
5 Dryers @ .75	= 3.75 kva	
12 General @ .69	= 8.28 kva	
	25.19 kva	

3. Summary	Morning Peak	Evening Peak
House Heating Load	16.26 kva	13.8 kva
Other Load 25.19 x .65	16.40 kva	25.19 kva
	32.66 kva	38.99 kva

The estimated load is 38.99 kva, 4% over the full load rating of a 37½ kva transformer. This size transformer would be satisfactory for present loads and increases through 30-35 kva.

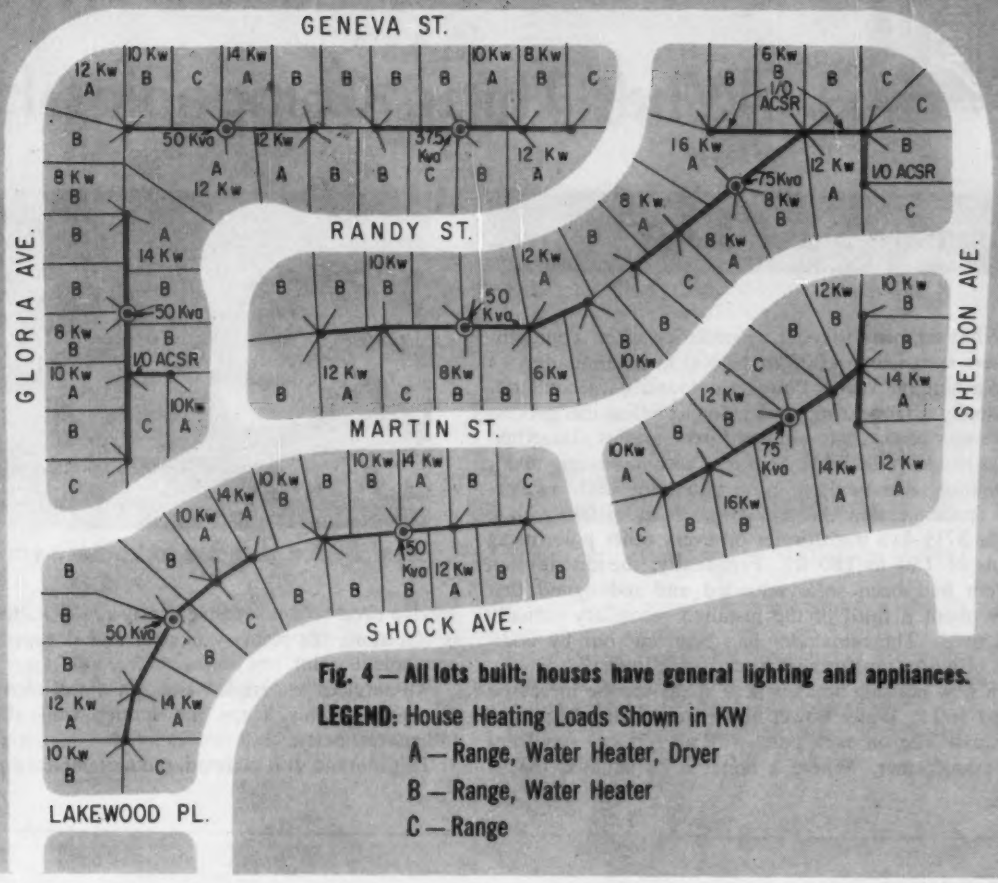


Fig. 4 — All lots built; houses have general lighting and appliances.

kv because of house heating. On the AG&E system, subdivisions of more than 300 to 400 homes are rare, and no subdivision has been developed where a complete system was installed specifically because of the heating.

Overhead mechanical design features, constructed for heating loads, would include bare ACSR primaries and ACSR DEWP secondaries. The least costly type URC weatherproof insulation is used for secondaries. This has an inner cellophane barrier which facilitates removal of the weatherproof covering for taps and splices. Construction is designed to provide adequate clearance of hardware to prevent television and radio interference.

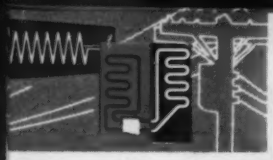
Sectionalized Primaries Localize Outages

Primary lines are sectionalized, where practicable. Fast first trip of station breakers and reclosers temporarily clears faults, and slow second trip isolates permanent ones by means of properly selected line fuses. Fuses afford short-circuit protection to transformers, and lightning arresters are connected on the line side of the cutouts. On wye systems, transformers are interconnected solidly, and delta-system transformers may be interconnected solidly where local inspection authorities permit it. In short, everything within reason is done to assure good service and adequate voltage with a minimum of interruptions.

The AEP system has promoted residential heat pumps for many years and space heating for three or four. As of January 1, there were about 10,000 space-heated residences served, including nearly 3,000 added in 1957. The system expects the rate of growth to accelerate. On such a widely extended system, space-heated residences now represent a tiny percentage of the possible heating customers.

Space heating is becoming more popular in new homes, its attraction lying in its low initial cost and the savings in building costs from elimination of chimneys and other appurtenances of a central heating system. Cleanliness and flexible control through a thermostat in each room are also important assets. It is used widely to heat added rooms.

Business areas in Central and Northern cities are beginning to experience system load peaks resembling those caused in the South and Southwest by summer air conditioning. Such peaks are expected to rise in the former areas as residential air conditioning becomes more widespread and should soon create there summer peaks equivalent to the present winter ones. Usually, in winter, an electrically heated home has a 7 to 8 AM peak, not coincident with the present 10 to 11 AM system peak. The heating load will help, to a large degree, in offsetting the expected summer peak. When a house is well insulated, the average AG&E system energy rate for heating it is such that its operating cost is often competitive with heating by other fuels.



What Three Companies Have

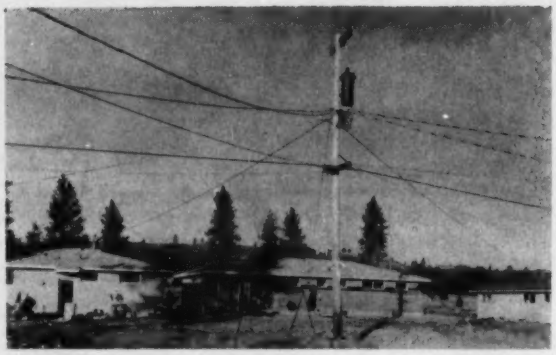
Eliminate Secondaries

What happens to your secondaries when your customers start using 8,000 to 10,000 kwhr annually?

Washington Water Power Co found its secondaries gradually disappearing. It decided to follow this process to its completion and eliminate secondaries altogether.

As residential load skyrocketed with increasing major appliance saturation and more recent emphasis on electric space heating, Water Power found itself with a 25 or 37½-kva transformer on every other pole (using spans of 150 to 180 ft). Frequently, the distribution system had been so overloaded and redesigned that only about a third of the installed secondary actually was used. The remainder had been cut out by addition of more transformers to carry the load.

In new housing areas, where spans can be increased up to 360 ft, Water Power now places a transformer of adequate size on each pole, with all services run from the transformer. Where a home is so situated that a service drop will not conveniently reach it, the service is run along the primary neutral and dropped off at a convenient point.



Services run directly to homes near pole . . .

All services are triplex and run direct to a mast on the house. This keeps the service well above customer's property.

This method, it is claimed, reduces capital costs about

Use Aerial Cable Equipment

R. M. ZIEGLER, Distribution Field Engineer, Southeastern Division, Louisiana Power & Light Co, Metairie, La

A distribution scheme consisting of primary and transformers on side streets and secondary cable along the rear-property line has been installed by Louisiana Power & Light Co. This type distribution is an economical, better-appearing means of serving a tree-studded subdivision, with an initial undiversified demand per home of 6 kva single-phase and some 3-phase for central air conditioning. As the home demands grow to 22.5 kva, more cables can be added and the transformers enlarged at little expense.

The Red Gate subdivision, near Kenner, La., presented a particularly bad tree problem to distribution designers. All 28 lots have many large trees, each valued at several hundred dollars. Excessive trimming and removal of trees were prohibited by the subdivision owner. Fortunately, they were spaced enough along the rear lot line to permit clearance for secondaries.

Homes under construction range in price from about $25,000 to $35,000, and each is expected to have the major appliances and air conditioning.

To serve these homes without costly tree trimming, the company ran 4/0 quadriplex aluminum service cables along the rear property lines. At the side street the cables connect to open-delta transformer banks supplied from 13.8-kv overhead primaries on the side street.

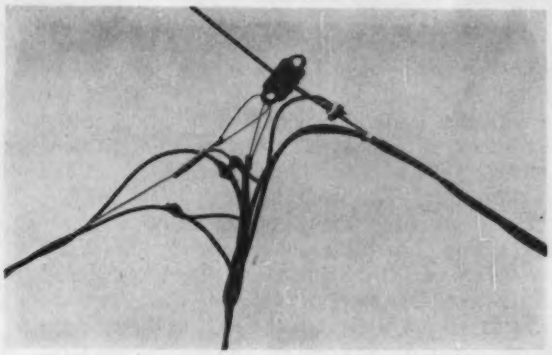
Actual cost of installing the additional facilities totaled $4,767. This includes $2,107 for purchase of four transformers. Installed cost of the scheme was compared with that of installing transformers and primary similarly on the side street but with open-wire secondary on the rear-lot line. Standard open-wire construction was estimated to cost $4,650. But secondary cable is neater and helps postpone the day when customer preference may force distribution underground.

Of even greater importance is the fact that the cable scheme selected provides greater flexibility for growth. As load increases, another cable can be "bundled in" more easily and cheaply than installing more open-wire secondary, reconductoring, or extending primary along rear lot lines. Transformers will be enlarged without increasing their number or relocating them.

Addition of a second cable and changeout of the transformers will double the maximum load that can be supplied. Installation of a third cable and other transformers will provide for a maximum of 22.5-kva undiversified demand per home.

This expansion plan permits the company to maintain its policies regarding residential service quality and equipment loading. Standard practice is to load transformers initially to 90 to 100% of nameplate and replace them at 150% of nameplate rating. At initial design loading the secondary voltage drop is limited to 2% and at 150% loading to 3%. Voltage variation at

Done to Serve New Residential Loads



but some follow primary neutral to . . .

pulloff supports closer to mid-span homes

a third, with little increase in transformer capacity, over the conventional secondary method. It permits use of shorter poles and requires less manpower and equipment to install. Storm and tree maintenance is lowered.

Electrically, the scheme shows less secondary drop from transformer to customer, no overloaded secondaries, and fewer transformer burnouts caused by secondary short circuits.

Water Power reports better customer acceptance for this construction and believes that the distribution system allows greater flexibility for load changes.

Additional benefits are lower stores inventories, and a safer system for linemen to work on.

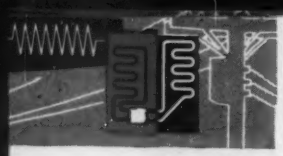
PRIMARIES and transformers are on side streets, and 4/0 quadriplex aluminum secondaries run along rear-lot lines

the meter is held to a maximum of 5% (6 v) with all customers receiving voltage between 114 and 126 v.

This plan to keep primary and transformer installations along the cross streets in subdivisions served from rear property lines offers economy in installation and maintenance. Initial cost is reduced by use of shorter and lighter poles in an inaccessible location with a reducton in primary circuit length. Tree trimming costs will be cut as will damage to floriculture from replacing large transformers or heavy poles.

Before installation of the quadriplex cable, test spans were put up to determine the best methods of connecting service drops. The company tried spreading the secondary conductors on a 4-point rack at each pole for greater clearance. But this practice was discarded in favor of a spreader tool used to separate conductors during tapping.

Adequate insulation between the service-drop connectors on the Neoprene-covered phase wires and bare neutral is provided by using polyethylene sleeves. The split sleeves are made by stripping about 2 ft of insulation off scrap conductor. These sleeves are taped to the bare neutral adjacent to the connectors on the phase wires.



Bolsters Cable System

H. B. **FRIEDRICH**, Underground Engineer, Kansas City Power & Light Co, Kansas City, Mo.

Load growth and conversion of 4-kv to 13.2-kv systems in surrounding areas prompted recent changes in a Kansas City Power & Light Co residential underground distribution system. Moreover, the 26-year-old direct-buried, 5-kv primary cable was becoming difficult to maintain. The cable, looping through area transformer vaults, joined two terminal poles.

On the older system, two 25-kva transformers had served ten customers, and coincident demand last year climbed to 75 kva.

Two new 15-kv cables now replace the deteriorated ones and afford the additional capacity. They are fed from a new 13.2-kv, 3-phase overhead distribution circuit. They are in direct-buried, 4-in. asbestos ducts for protection and to facilitate maintenance and replacement. A single duct was used except where fault communication to another cable would leave customers without service. Two ducts were installed to Terminal Pole 2 and to Manhole 2843 below, and three single-conductor, 15-kv cables from Terminal Pole 1 to Terminal Pole 2 are the through feed for the overhead circuit.

Three 50-kva, single-phase, self-protected transformers have replaced the 25-kva units, each fed from a different phase to keep the circuit load balanced. Terminal Pole 2 serves a small isolated overhead system adjacent to the underground area.

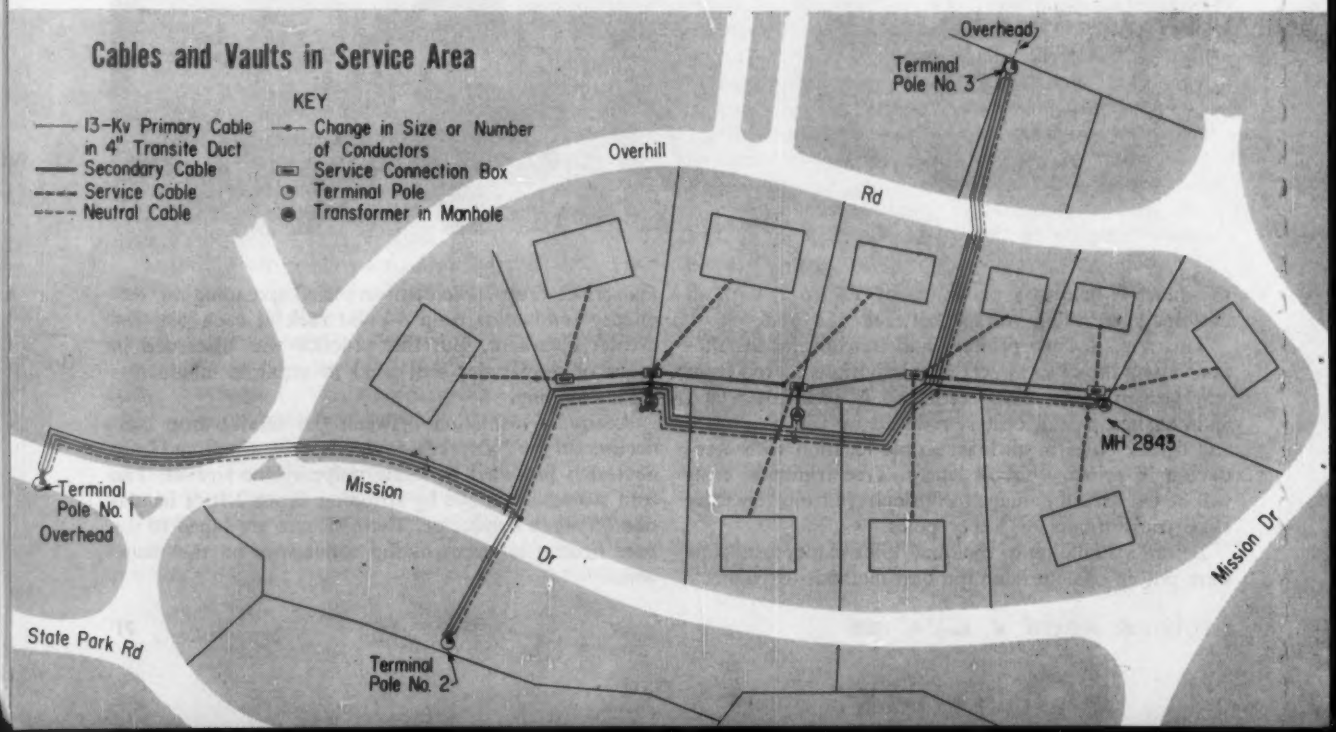
Transformers were installed in special semi-buried vaults with precast concrete bases and steel tops. Plastic barriers in the vaults keep personnel clear of 7,600-v bare energized leads. The circuit is de-energized before the vault is opened. Necessary switching is done by removing the bare leads between the pothead and the transformer. The vault is then closed and the transformer energized through one pothead.

One section of cable and its associated potheads can be de-energized for maintenance or troubleshooting. With the insulating barriers protecting them from the energized portion, personnel can test on the de-energized pothead through a sliding door. There are three sliding doors in each steel vault, one for each pothead compartment and one on the secondary side for access to the signal light and reset handle. The concrete bases are set over gravel to provide drainage.

The old transformer vaults were 36 in., in dia; the new ones, 48 in. Sewer tile bends were used to bring the ducts into the transformer vaults, because they were shorter and of smaller radius than conduit bends. The bell end of the tile was fitted over the 4-in. duct. This combination worked well.

Primary cables are 1/0, single-conductor, 15-kv, PILC with polyethylene jacket. They are wiped onto potheads to keep them sealed.

Four splicing areas consist of one tier of concrete blocks with 2-in. creosoted boards laid on top and dirt backfill over all. The bared lead sheath was taped with a butyl tape, and magnesium anodes were installed for corrosion protection.



FORM 400C
250 or 400 watts
IES Type II, III, IV

Another FIRST from the Outdoor Lighting Center of the World

NEW FORM 400C MERCURY

For the first time, a mercury luminaire with acrylic refractor and one-piece reflector housing!

Get all the benefits of the new Form 400C for $4.40 per unit less than conventional mercury units. Cut first costs; cut maintenance costs; save money—at *no* sacrifice in performance! Here's what the new Form 400C offers you:

TOP PERFORMANCE—Outstanding light control and utilization on the roadway are assured with the all-new unit! Refractor is *precision-molded* of acrylic material; attractive, efficient hood is of one-piece construction.

GREATER DURABILITY—New anodized aluminum housing *never* needs paint—a big saving for you! Thermal shock caused by cold rain suddenly chilling the refractor has *no effect* on the new Form 400C. Whatever the adverse condition—salt spray, industrial fumes, or blowing sand—the new Form 400C meets the test!

INCREASED SAFETY—Much annoyance of vandalism is eliminated because the refractor is *shatterproof*. Rocks and BB's bounce off. Bullets can puncture the refractor, but dangerous fragments do not fall to the roadway.

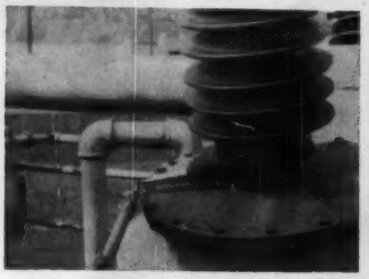
LIGHTER WEIGHT—The new Form 400C weighs only 10 pounds—less than half the weight of conventional mercury luminaires. Result: easier handling and easier, safer installation.

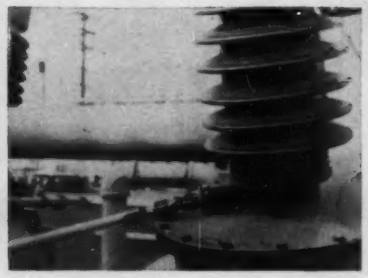
With the Form 400C, General Electric offers you *more* mercury lighting value for less money—both first cost and in maintenance. There's much more you'll want to hear from your G-E sales engineer or street lighting agent. General Electric Co., Schenectady, N. Y. 450-2

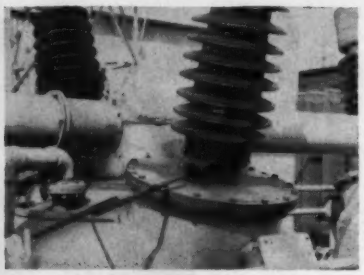
Progress Is Our Most Important Product

OPERATION upturn — Buy now for better values — GENERAL ELECTRIC

GENERAL ELECTRIC







HV Bushing Insulation Is Checked Hot

High-voltage bushing insulation condition now is checked in service by Seattle City Light. Savings over the former method, which required de-energizing the OCB, are estimated at about $1,000 annually. The new technique uses specially designed hotstick tools and test leads for checking bushings in the 115- and 230-kv class.

City Light runs six-month insulation checks. This program, by recognizing incipient trouble, has prevented unscheduled outages due to bushing insulation failure.

Formerly it was necessary to clear an OCB, often at night or on overtime, to apply an insulation test. Often load conditions delayed scheduled tests appreciably.

The relay section of City Light designed a socket ratchet wrench hotstick attachment for loosening the potential tap terminal plug, and a mechanical finger device for removing it. With the HV male terminal exposed, a test HV lead socket is connected, using a special micarta tubing "hotstick".

Capacitance-tap voltage readings are made with a vacuum-tube voltmeter. Higher than normal readings indicate one or more condenser layers are shorted and insulation breakdown has occurred. A further check is made with a carrier-frequency voltmeter to determine the radio influence voltage generated by the bushing. Normal readings run 250-500 microvolts. A reading two millivolts or more indicates deteriorated bushing insulation.

Records of individual bushings are kept. Any bushing showing progressively higher readings is taken out of service, thoroughly shop-tested, and repaired or replaced if necessary.

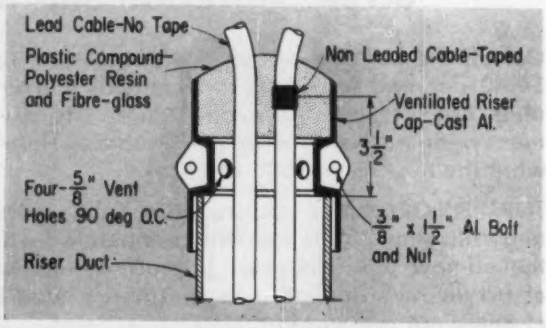
Ventilated Riser Cap Ups Cable Ratings

Ventilated cable riser terminations increase current-carrying capacity of underground cable pole risers by 6 to 12%. New England Electric System found this out from tests, and now has a proposed standard calling for ventilated riser caps.

Riser ducts are often exposed to the hot sun. Measurements of ambient temperature during August 1955 showed that ventilated duct stayed about 5C cooler inside. This translates into 6 to 12% greater current-carrying capacity for the enclosed cable. Tests were on cable at 23 kv and below.

Cap to be used under the proposed standard is shown at right. It is split in half to fit easily over the riser duct. Halves are bolted in place. Four vents around inset waist, protected from weather, permit heated air to escape.

Top of cap is filled with a plastic compound (polyester resin and fiber glass) which supports cable. The


Lead Cable-No Tape
Plastic Compound-Polyester Resin and Fibre-glass
Non Leaded Cable-Taped
Ventilated Riser Cap-Cast Al.
3 1/2"
Four-5/8" Vent Holes 90 deg O.C.
Riser Duct
3/8" x 1 1/2" Al Bolt and Nut

compound grips lead-sheathed cable, but non-leaded cable must be taped. The compound is formed into a turtle-back shape to aid in shedding water.

Other advantages claimed for the ventilated cap are: Cables stay drier, reducing corrosion; gas leakage into conduit is vented out, reducing danger of manhole explosions.

(*More How To on page* 76)

POLE STAR IS THE

REGISTERED TRADEMARK of a complete line of distribution transformers manufactured by Pennsylvania Transformer Division, McGraw-Edison Company. We are grateful for the nationwide acceptance that has made the words POLE STAR almost synonomous with "distribution transformer."

We wish to remind that the user benefits associated with the name POLE STAR are obtainable, in their entirety, only with the distribution transformer products of this manufacturer.

McGRAW EDISON

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY, CANONSBURG, PA.

Sound Power Phones Ease Out-of-Sight Jobs

G. R. **ROBERTS**, Superintendent, Transformer Department, Toledo Edison Co, Toledo, Ohio

Sound power phones have proved adaptable to several applications, all making it possible to operate quickly, more efficiently, and often with reduced manpower.

The accompanying photographs illustrate the use of the phones where the operator of an oil filter tank wagon is pumping oil to a third-floor substation. The operator is in constant communication with the man at the valves during the oil-transfer operation.

The phones, which use 500 ft of wire, are also handy when moving transformers and equipment in out-of-sight places, especially in basements where the winch truck is operating from the street. The foreman can talk directly with the winch operator and control movement of the equipment. This makes it easier for the men to control the rollers, thus reducing the chance of damaging transformers or injuring workmen. Previously, two or three men were needed to transmit signals for such a job.

Canvas Cover Protects Bushing

Canvas covers used by Tennessee Valley Authority keep paint off bushings during spray painting of substation transformers and circuit breakers. The re-usable canvas covers replace brown paper, reducing installation time and material costs.

The light-weight covers are secured to the bushings by draw strings at both ends and tie strings in between. They are in two sizes: One for 161 and 110-kv bushings; the other for 66, 44, and 12-kv bushings.

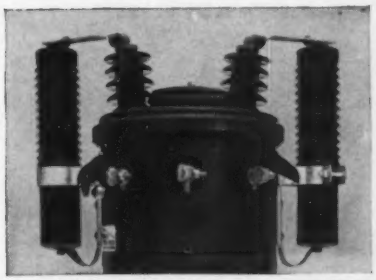
THE DELTA-STAR OVERALL SELF-PROTECTED TRANSFORMER*

gives you the most modern features in transformer design

Delta-Star OVERALL SELF-PROTECTED Transformers are small in size, light in weight, and easy to install. Contributing to these advantages are a new Porter Core, smaller coil, improved insulation, corrosion-resistant tank, and high-strength shipping crate.

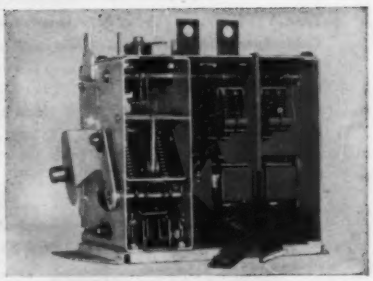
Delta-Star engineering has created an outstanding concept in OVERALL SELF-PROTECTED transformers. The most modern materials and methods have gone into the design. The reputation and experience of Delta-Star assures a quality product. In addition the transformer undergoes a series of rigid tests.

Send for illustrated catalog. You'll find complete information on this modern OVERALL SELF-PROTECTED transformer by writing
Dept. 14A
Delta-Star Electric Division,
H. K. Porter Company, Inc.,
17th and Cambria Streets,
Philadelphia 32, Pa.
. . . or to your nearest Delta-Star district office. ***PATENTS APPLIED FOR**



Coordinated Crystal Valve Arresters. Have increased arc-suppressive ability and surge current carrying capacity.

Operating Handle. "Reset—Open—Closed—Light." Unique operating sequence prevents accidental tripping.



Circuit Breaker. "Plus" breakers, calibrated at the factory, offer maximum available overload capacity.

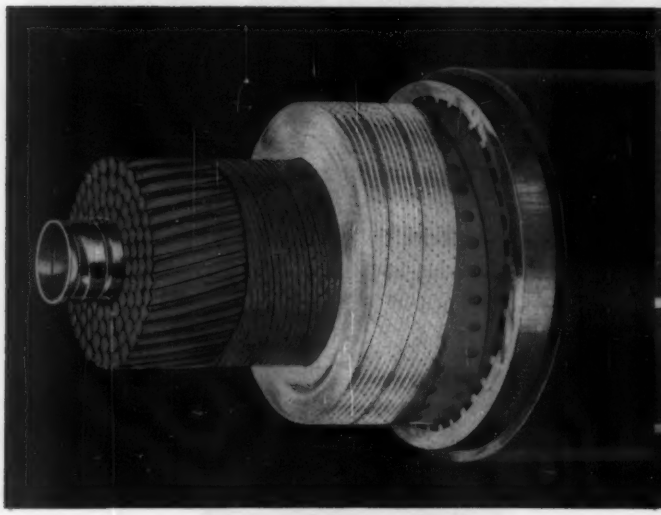
H. K. PORTER COMPANY, INC.

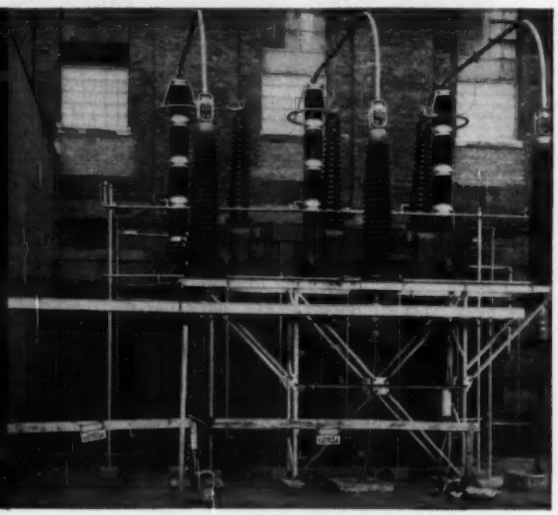
DELTA-STAR ELECTRIC DIVISION

Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

MADE BY PHELPS DODGE FOR NIAGARA MOHAWK...

FIRST LOW-PRESSURE, OIL-FILLED IN UNITED STATES NOW IN





Cable terminus at one end is power plant in which new 200,000 KW generating units are located.

CIRCUIT DATA AND CABLE RATING

Type	Low-Pressure, Oil-Filled to AEIC 5th Edition
Cable Rating (nominal)	230 KV
Number of Circuits	2
Number of Cables	7
Capacity, each circuit (at 95% daily load cycle)	240,000 KVA
Length, each circuit (approx.)	1,500 feet
Cable construction	
Steel spiral hollow core I.D.	500 mils
Conductor concentric copper	1,250 M.C.M.
Impregnated wood pulp paper (nominal thickness)	835 mils
Habirloy arsenical fluted lead sheath (lead over flutes)	160 mils
Habirlene (polyethylene) jacket	115 mils
Maximum operating oil pressure	16 psi
Type CC oil reservoir each end, each cable	21 gals.
Maximum conductor copper temperature	
Normal	70° C
Emergency	75° C
Potheads G & W type, ATL, low-pressure, oil-filled	230 KV
Installation, buried concrete trough and cover, (spacing between cables)	10 in.

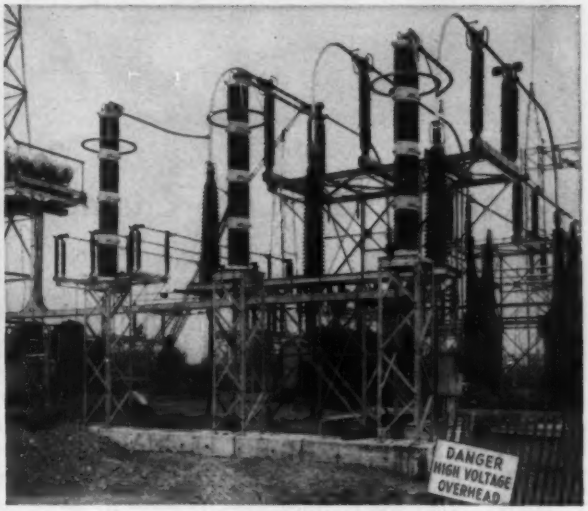
230 KV CABLE SERVICE

The first 230 KV low-pressure, oil-filled power cables for use in this country—made by Phelps Dodge Copper Products Corporation—were recently placed in service at Niagara Mohawk Power Corporation's Charles R. Huntley Station near Buffalo. The cables were installed by direct burial, a new method of laying cable of this voltage in the U.S. An unusual feature of the cable design was the selection of a protective jacket of corrosion-proof polyethylene for use over the cable's lead sheath.

The cables will integrate new generating units into the Niagara Mohawk System by linking the main step-up power transformers to the 230 KV switchyard. Three single conductor cables are assigned to each of the two circuits, together with one spare cable. All cable lengths are continuous without splices.

The selection of Phelps Dodge to manufacture these cables—the vital link in the 230 KV system—is indicative of the confidence placed in Phelps Dodge's practical experience and reputation in pioneering the widest range of power cables in the industry.

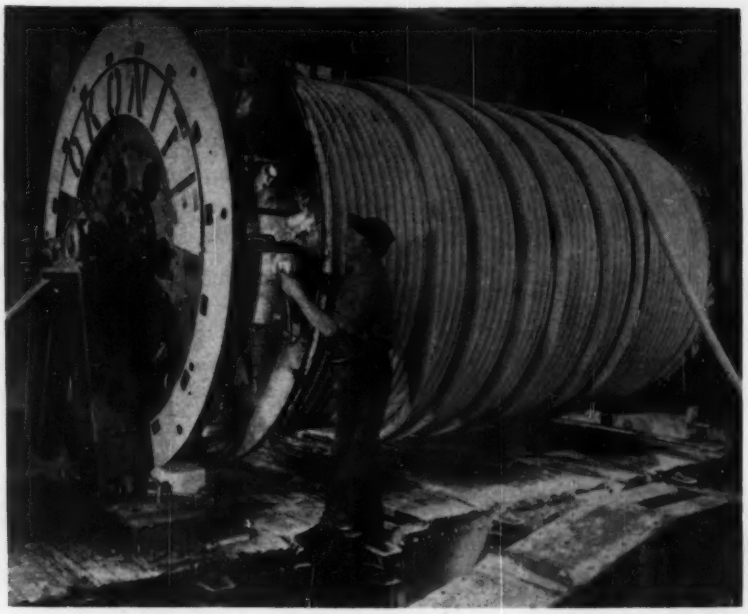
Pulling cable into ditch for direct burial. In final stage, cable was seated in a sand-filled trench. Concrete slabs were placed above the sand for mechanical protection.



Switchyard, view showing cables terminated in potheads with gravity reservoirs in position on tower.

PHELPS DODGE COPPER PRODUCTS CORPORATION

300 PARK AVENUE, NEW YORK 22, N. Y.



Okonite Loads Lake Champlain Cable

The first of four 115-kv paper-insulated cables for New York Power Authority's Lake Champlain crossing (EW, Sept. 23, 1957, p 125) is here being readied for shipment. Manufactured in a single, 9,000-ft length to avoid splices in the crossing, the Okonite Co claims the cable on this reel is the longest piece of oil-filled cable ever shipped. Oil pressure will be maintained during shipment and installation by 12 reservoirs, six connected to each end of the cable. Each cable weighs 61 tons and the reel, with reservoirs, adds 13 tons to the shipping weight.

The four loaded reels will be delivered by railroad cars to New York Harbor. They will be transferred by barge to the crossing site, traversing the Hudson River, Champlain Canal, and Lake Champlain itself.

Kearney Adds Test Unit for Sleeve Holding Power

Testing facilities of the James R. Kearney Corp, St. Louis, Mo, have been increased by the addition of a Riehle 60,000-lb horizontal testing machine. With this equipment, tests are conducted on compression splicing sleeves and allied products with accuracy of less than ½ of 1%.

Tests can accurately be made to closely correlate sleeve length, wall thickness, material, number of indents, and the effect of metalizing with holding power. Beside being able to conduct tests on all types of conductors, the 6-ft power stroke of the straining head permits the machine to be used in testing material with a high degree of elongation. On ACSR conductors the core is prevented from pulling out of the gripping jaws by a technique which locks the aluminum and steel together.

Cap Designed to Ventilate Cable Riser at Pole

A ventilated cable riser termination called the Condulator has been developed by Roberts Electrical Products Co, Boston, Mass. This cap is placed at the open end of a pole riser, is available in 2, 3, 4 and 5-in. sizes, and will fit any conduit material, according to the manufacturer. It is split in two halves to permit installation or removal while cables are in place. In addition it is said to secure any number, size or configuration of cables against slipping back into the conduit.

According to tests the ambient air temperature is about 5 C lower in a ventilated pipe riser than in a sealed one. Thus, depending on cable construction, the current carrying capacity gained will be approximately 6 to 12%.

Foster Wheeler Has Order for 2nd Mercer Steam Unit

A second steam generator has been ordered from Foster Wheeler Corp, New York, by Public Service Electric & Gas Co for installation at the utility's Mercer Generating Station near Trenton, N. J.

This natural circulation, reheat, twin-furnace type steam generator is identical to the first unit. It will have a steam capacity of 2,060,000 lb per hr at a turbine throttle of 2400 psi and 1100/1050F. Fuel will be pulverized bituminous coal.

Foster Wheeler is also furnishing two steam generators for the Bergen Generating Station and one for the Mercer Station. Total capacity for the four units including the new unit will be approximately 8,000,000 lb of steam per hr, representing 1.22 Mw generation.

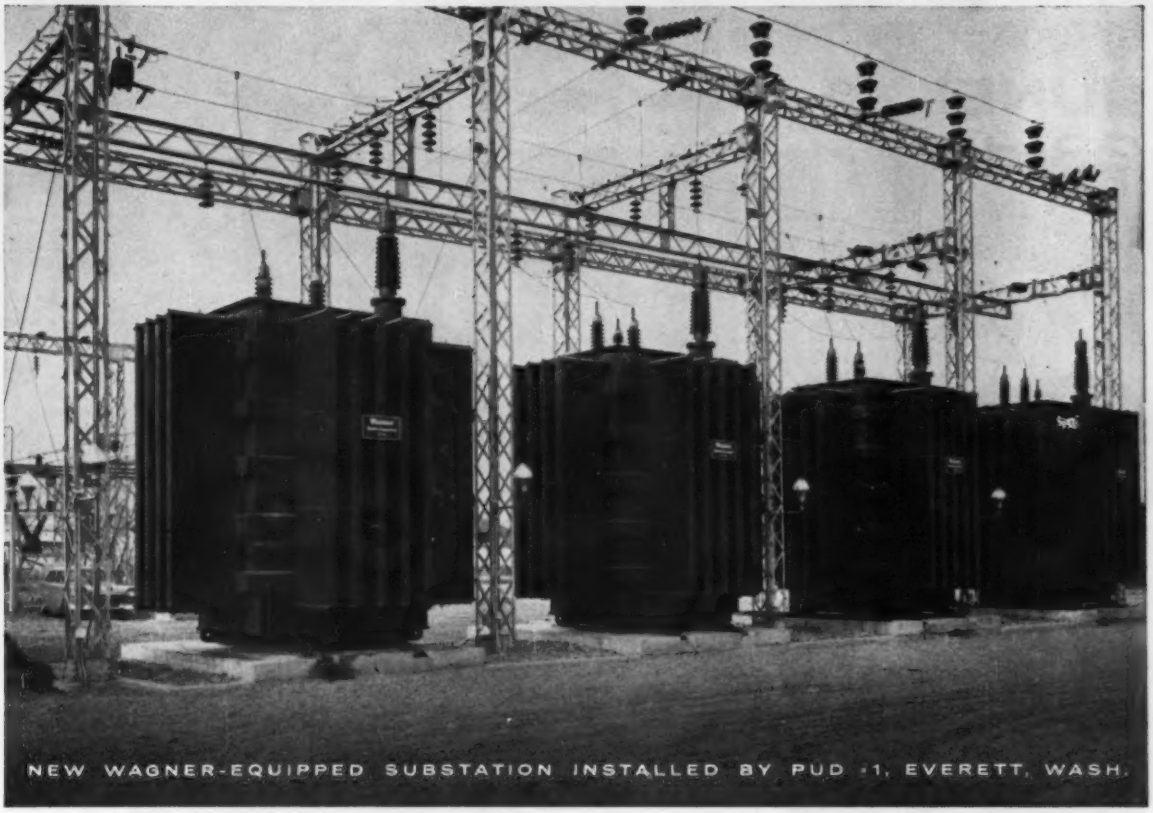
Delta-Star Switch Design

Delta-Star Div of H. K. Porter Company Inc, Chicago 12, has published a technical article about the basic problems of outdoor switch design. The article, prepared by G. Buchanan, asst. general sales manager, is entitled "Principles of Outdoor Switch Design and Comparative Design Chart." A comparison is made of design features.

(*More Manufacturers News, page* 82)

MORE WAGNER TRANSFORMERS

add system capacity for Snohomish County



NEW WAGNER-EQUIPPED SUBSTATION INSTALLED BY PUD #1, EVERETT, WASH.

With system demand growing at the rate of 9% annually, Snohomish County PUD is adding capacity with more and more transmission and distribution substations.

This recently completed substation is equipped with four Wagner single-phase power transformers rated 10,000/13,333/16,667 kva, 110,000 GrdY to 55,000 Delta Volts.

Wagner builds standard and special power transformers to meet practically all kva and voltage requirements. Consult Wagner about your next power transformer installation. 32 branch offices are at your service. Wagner Bulletins TU-181 and TU-16D tell the whole story. Write for your copies today.

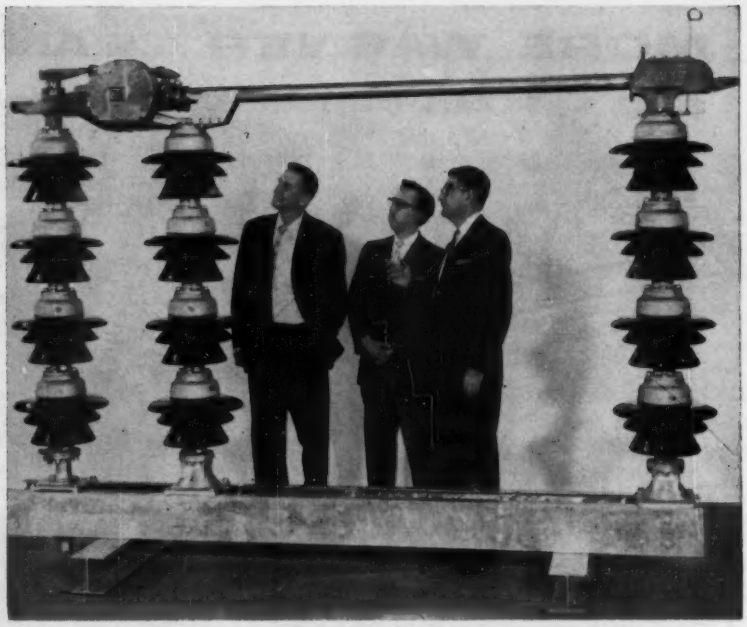
Wagner Electric Corporation
SERVING INDUSTRY SINCE 1891

WT58-14

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS—AIR AND HYDRAULIC



Switch Carries More Than 120,000 Amp

A high-voltage switch, able to stand the kind of momentary surge possible with today's interconnected systems, has been developed by Electrical Engineers Equipment Co, Melrose Park, Ill. The utmost capacity of the contact system is not yet known, but the unit continued to function efficiently after reaching the extreme output of the testing facility, over 120,000 amp, according to the manufacturer. Features of the HM50 switch hold the blade closed and undisturbed during high momentary current transients.

Presently available in ratings from 69 kv through 161 kv and from 600 to 2,600 amp, it will be produced later in higher voltage ratings. Shown checking a 161-kv switch are O. B. Alsaker and Mel Rathbun, designers, and Charles Koerner, 3E vice president.

GE Radio Systems' Unit May Reduce Interference

General Electric's Communications Products Dept, Syracuse, N. Y., is field testing a power control unit for two-way radio systems which may eventually help reduce some of the communication industry's interference problems.

The device automatically adjusts signal output of a base station transmitter so the signal transmitted is no more than needed to reach a specific mobile receiver.

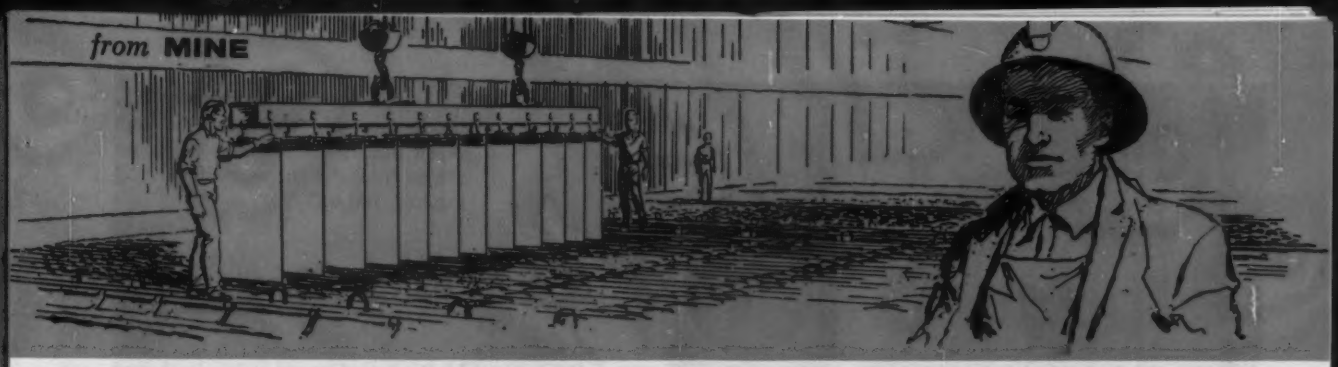
First tests have been conducted at the Niagara Mohawk Power Corp, Syracuse. It is hoped that the use of the device will result in less co-channel interference and more effective utilization of the radio spectrum.

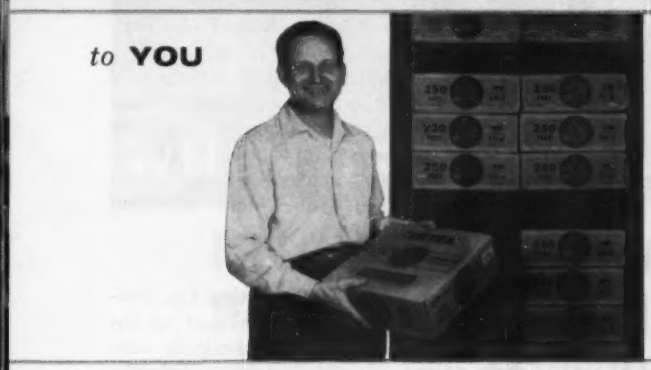
Before installation of the power control in a 250-w transmitter of the power company, the Syracuse base station would "boom out" on full power on all calls, sometimes interferring with some of the 21 other base stations in the utility's central division communications network.

U. S. Aluminum Production

Primary aluminum production in the United States for the month of April was 128,491 tons, according to The Aluminum Association, New York. This was a decrease of 9,425 tons from March amount. Total

(*Continued on page* 84)





ONE SURE SOURCE OF SUPPLY

for all your wire and cable needs

In wire and cable, contractors look for reliability of product, ample stocks, and friendly service. Working through a Circle distributor, you're assured of all three . . . and here's why.

Take *product reliability*. Quality control begins right with the basic metals mined and refined in Cerro's own facilities. Here skilled men make sure that every bar of copper, lead, or zinc is of the proper purity. This same attention to quality control is maintained throughout manufacture.

Ample stocks? Circle supplies the trade with over a billion feet of top quality wire and cable yearly — distributed through well stocked, conveniently located warehouses across the country.

Service? There's no "red tape" at Circle. When your distributor needs fast action, a simple telephone call brings results. So make a Circle distributor *your* "one sure source of supply"– many other satisfied customers do.

C W C **CIRCLE** **WIRE & CABLE**
a subsidiary of
CERRO DE PASCO CORPORATION

PLANTS: Maspeth and Hicksville, N. Y. **SALES OFFICES & WAREHOUSES:** in all principal cities

RUBBER COVERED WIRES & CABLES • VARNISHED CAMBRIC CABLES • PLASTIC INSULATED CABLES
NEOPRENE SHEATHED CABLES • "CIRTUBE" EMT

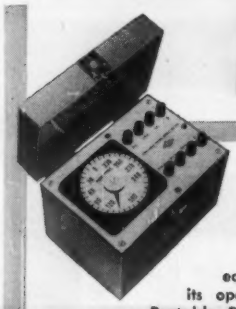
Quality S-1 Meter Socket Earns Utility Acceptance!

General Electric's top-quality S-1 square meter socket has been accepted by more utilities throughout the country than any other socket in its class.

Ask your G-E salesman. He'll show you the reasons why. 628-15

GENERAL ELECTRIC

PORTABLE PHASE ANGLE METER



Completely self-contained, and requiring no auxiliary equipment for its operation, this Portable Phase Angle Meter offers a direct way of checking relay and instrument connections, particularly directional over-current relays, differential relays or similar equipment. It may also be used to measure the prevailing power factor in each phase of a polyphase watthour meter installation. The device has a frequency of 60 cycle, with voltage ranges of 60, 120 and 240 volt. Current ranges are 1, 2.5 and 5 amp. . . . DIMENSIONS: 9½ x 6¾ x 5⅝ inches. Weight 19 pounds.

Also available in other voltage combinations

Write for Bulletin #75 for complete information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA

MINERALLAC "PULL-IN" COMPOUND No. 100

LISTED and APPROVED by UNDERWRITERS LABORATORIES

For Rubber, Synthetic, Plastic or Lead-Covered Wires or Cables

Approved by Underwriters Laboratories for lubricating wires and cables to facilitate pulling them into conduits. Not injurious to wire or wire covers. Free of objectionable odors. White in color. Will not drip or run. Conveniently packed in pint, ½ gal., gal. and 5 gal. cans. Available through your electrical jobber.

MINERALLAC ELECTRIC COMPANY
25 North Peoria Street, Chicago 7, Illinois

MINERALLAC

(*Continued from page* 82)

production for the year through April was 531,918 tons, a slight decrease from the corresponding 1957 total of 540,947.

MANUFACTURERS BRIEFS

Multi-Amp Corp, Union, N. J. has a mobile testing unit rated 15 kva for both high-current, low-voltage testing of protective devices, and high-voltage, low-current for testing of insulation. Current rating is 6,000 amp continuous, and 15,000 amp short time. High voltage rating is 40 kv.

Anaconda Copper Co, New York, has acquired the Cochran Foil Co, manufacturer of aluminum sheet, foil and laminated foil products. All assets and properties have been transferred to Cochran Foil Corp, a newly-organized and wholly-owned subsidiary of Anaconda Co. Through another subsidiary Anaconda is constructing an aluminum fabricating plant at Terre Haute, Ind., to produce aluminum plate, sheet, rod, tubes and extruded shapes.

Osmose Wood Preserving Co, Buffalo, N. Y., has developed an injection solution to eliminate ants and termites where infestation is discovered in wood poles. The solution has an insecticide for permanent effect; an insecticide capable of generating active toxic vapors to reach areas not contacted by the solution; and a wood preservation to stop decay in areas reached by the solution. In field application, main chambers are established through boring, then the solution is injected under pressure, and the holes are plugged with treated dowels.

Honeywell: Minneapolis-Honeywell Regulator Co has unveiled an electronic "brain" to supervise the operation of the air conditioning system in the new, 21-story Queen Elizabeth Hotel, Montreal, Canada. One engineer at the Supervisory Data Center has the graphic representation of the entire air conditioning system in front of him.

KNOW - DON'T GUESS - HOW YOUR PROTECTIVE SYSTEM OPERATED

***with the* HAMILTON AUTOMATIC OSCILLOGRAPH, RS-9 THIRTY**

. . . provides proof of sequence of relay and breaker operation . . . a permanent, accurate record of what happens when a fault occurs.

The Hamilton Oscillograph, RS-9 Thirty, provides constant vigilance over your high voltage lines. It shows when a relay or breaker protecting the line is slow acting or erratic...often indicating faulty equipment before it can cause costly down-time.

The RS-9 Thirty stands by, constantly monitoring your system with as many as 32 channels. Then, within 2 milliseconds after a fault occurs, it is automatically at work recording the transient wave forms, giving you a sharp, easy-to-read record of everything that happens to your system for the duration of the fault.

Also available—a 14 channel automatic oscillograph, RS-9 Fourteen; and an automatic record developer, SD-10.

HAMILTON WATCH COMPANY
HATHAWAY INSTRUMENT DIVISION
5800 E. Jewell Ave., Denver 22, Colo.

Send for an actual chart recorded by an RS-9 Oscillograph. See for yourself how easily the chart can be analyzed. Mail the coupon TODAY.

To: HAMILTON WATCH COMPANY
Hathaway Instrument Division — 5800 East Jewell Ave., Denver, Colo.

Gentlemen:
Please send me an actual chart recorded by an RS-9 Automatic Oscillograph.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

A JOINT VENTURE THAT LED TO A NEW DEVELOPMENT IN SUBSTATION CONSTRUCTION

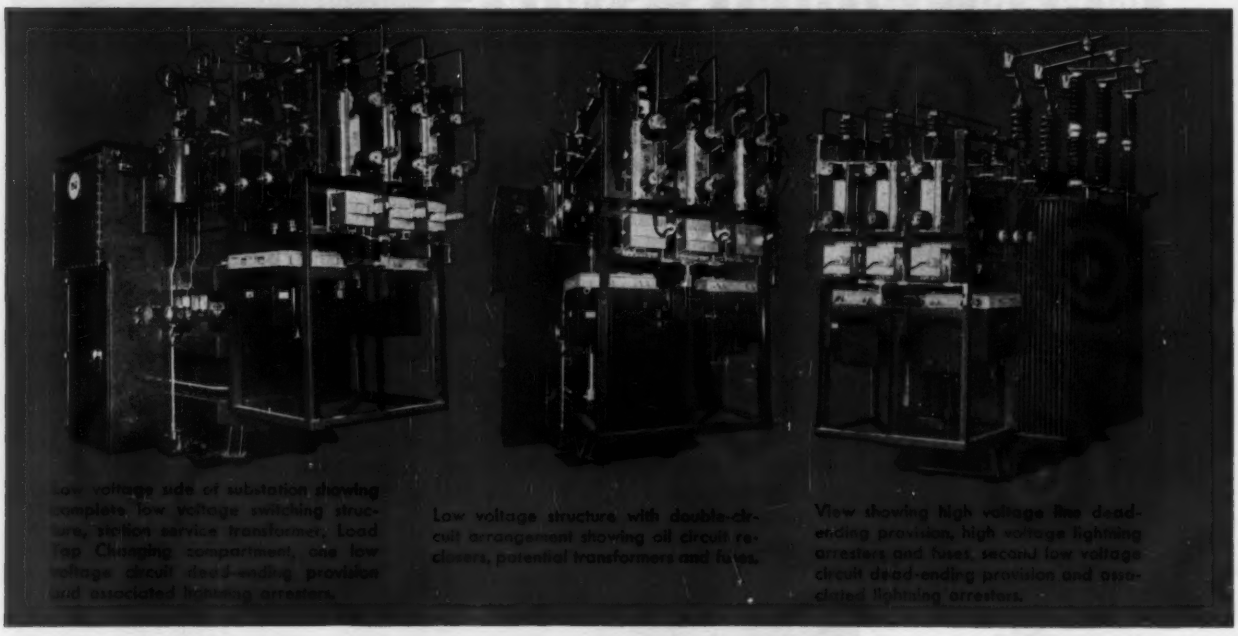
Double-Circuit Integrated Substation . . . An efficient, economical means of serving outlying areas, developed through the combined efforts of Public Service Company of Indiana, Inc., and Moloney Electric Company.

The recent shipment of this unit, which is the first of this type to be built, is the climax of many design conferences between representatives of the two companies.

The Double-Circuit Integrated Substation is an outstanding example of how user and manufacturer may work together to develop the new products necessary to solve the increasingly difficult problem of providing economical yet dependable service to the utilities' customers.

The ability and the facilities of Moloney Electric Company stand ready to assist you in the solution of your transformer problems.

MEEB-7

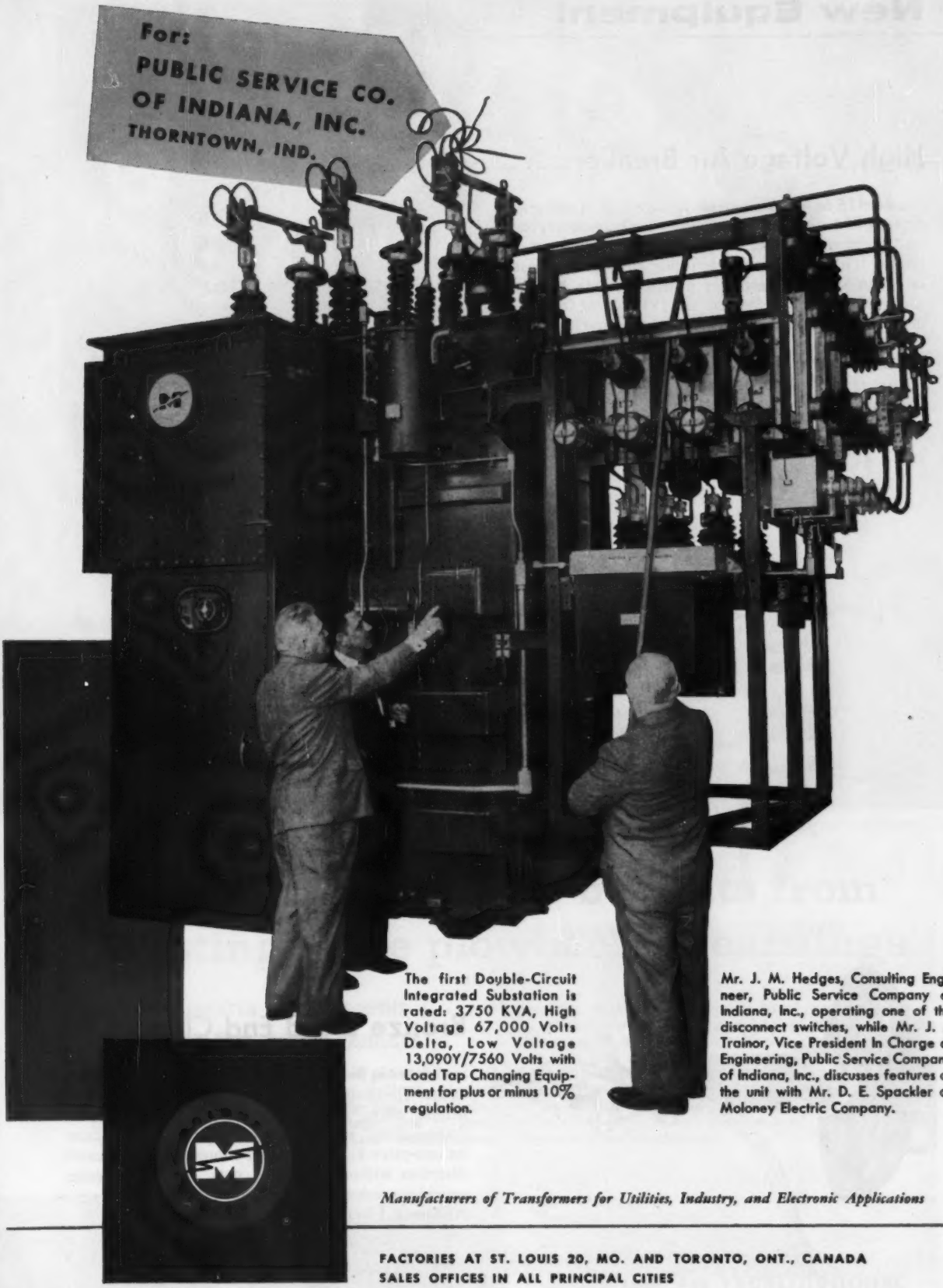


Low voltage side of substation showing complete low voltage switching structure, station service transformer, Load Tap Changing compartment, one low voltage circuit dead-ending provision and associated lightning arresters.

Low voltage structure with double-circuit arrangement showing all circuit reclosers, potential transformers and fuses.

View showing high voltage line dead-ending provision, high voltage lightning arresters and fuses, second low voltage circuit dead-ending provision and associated lightning arresters.

MOLONEY ELECTRIC COMPANY



The first Double-Circuit Integrated Substation is rated: 3750 KVA, High Voltage 67,000 Volts Delta, Low Voltage 13,090Y/7560 Volts with Load Tap Changing Equipment for plus or minus 10% regulation.

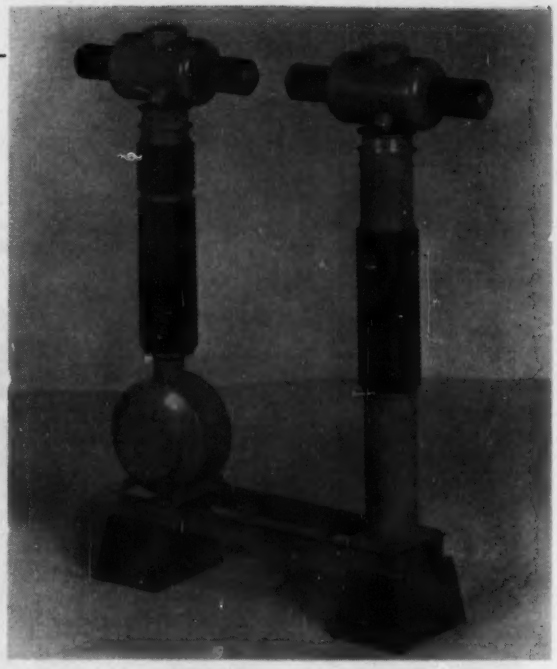
Mr. J. M. Hedges, Consulting Engineer, Public Service Company of Indiana, Inc., operating one of the disconnect switches, while Mr. J. J. Trainor, Vice President In Charge of Engineering, Public Service Company of Indiana, Inc., discusses features of the unit with Mr. D. E. Spackler of Moloney Electric Company.

Manufacturers of Transformers for Utilities, Industry, and Electronic Applications

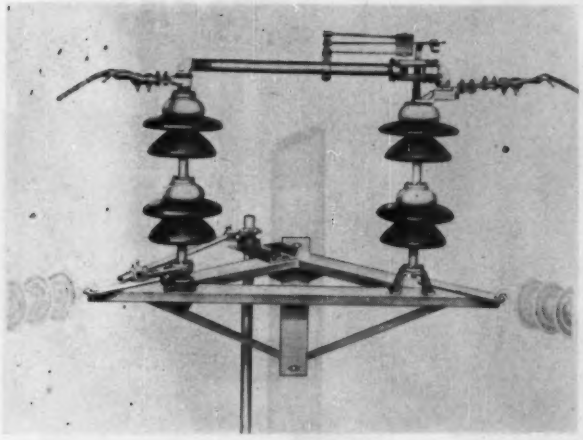
FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA
SALES OFFICES IN ALL PRINCIPAL CITIES

New Equipment

High Voltage Air Breakers . . .

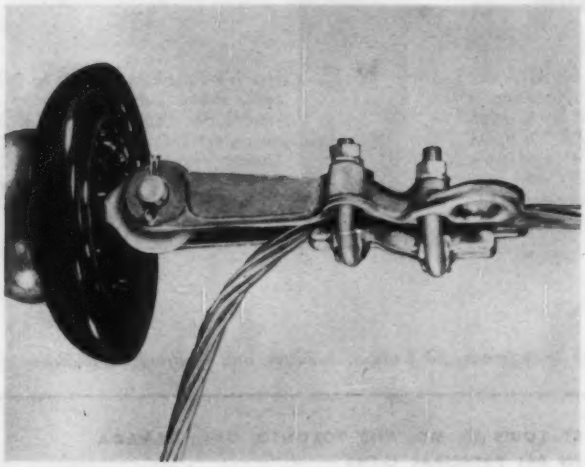


. . . for 115 to 460-kv systems feature high speed interruption and withstand maximum voltage recovery rate on transmission lines. They require 75% less out-of-service time for routine interrupter inspection. Based on a pressurized interrupter principle, these breakers use modular units. Starting at 115 kv, 11,000 mva interrupting capacity, each added column increases voltage and interrupting capacity. Four columns in series provide one phase of a 460-kv breaker with 33,000-mva interrupting capacity.
General Electric Co, Schenectady 5, N. Y.



One-Way Ganged Air Break

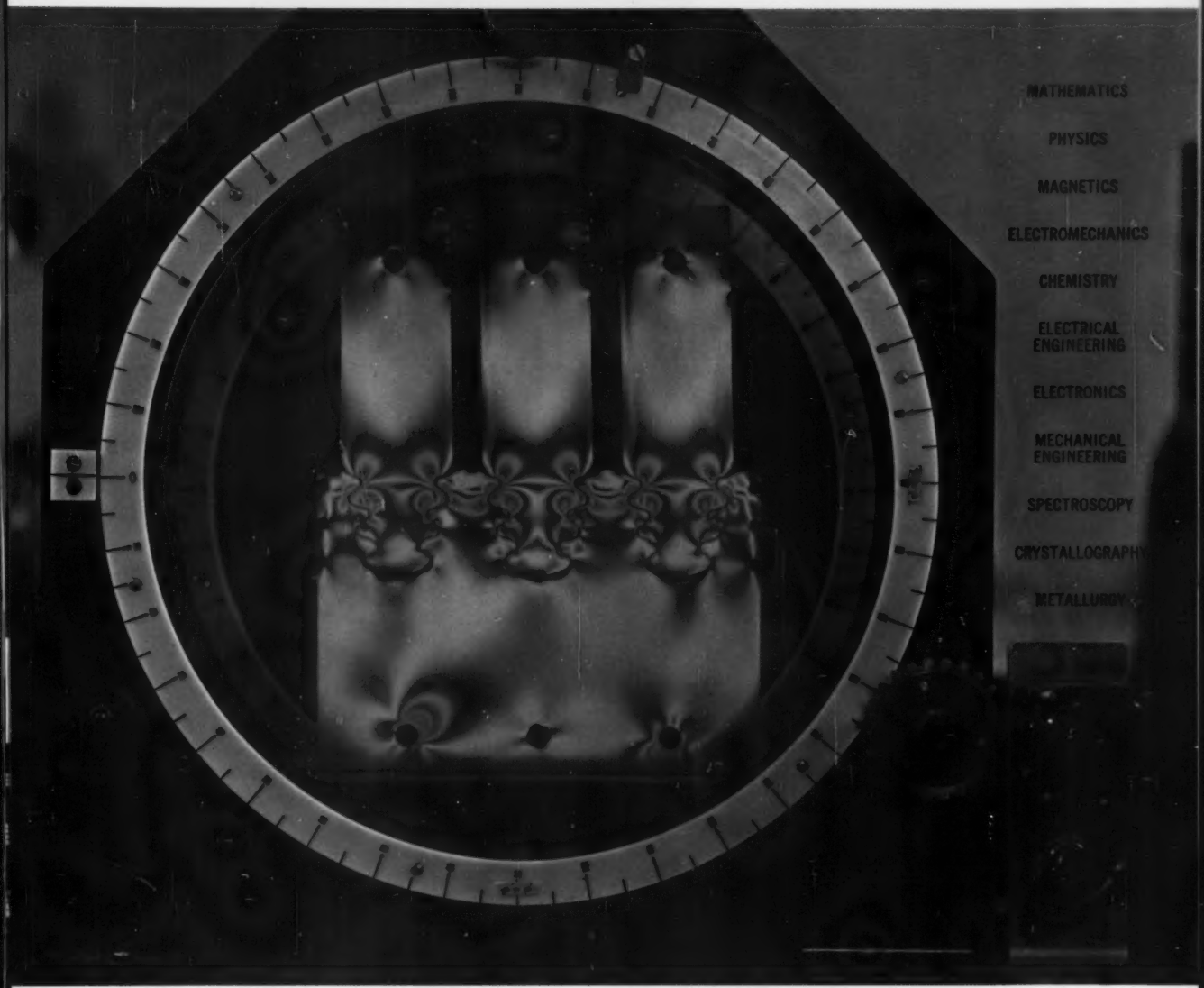
. . . for single circuit switching of phase-over-phase lines is available in ratings of 34.5, 46, and 69 kv, at 600 and 1,200 amp. The one-way GOABS comprises 3-phase side-break switch, mounting frames for each phase, and complete control mechanism for mounting on single pole. Right-angle frame design makes it suitable for "corner" installations. Phase-over-phase arrangement provides free climbing and working space. Braidless, high pressure switches have high-speed snap-out arcing horns for interrupting magnetizing or line-charging currents.
A. B. Chance Co, Centralia, Mo.



Bronze Dead End Clamp . . .

. . . comes in five sizes with 0.18 to 0.98-in. clamping range. Designated Type BDE, it is cast, high tensile, bronze alloy, straight line clamp, equipped with "come-along" eye for ease in sagging cable. U-bolts on one-piece keeper are long enough to permit cable insertion without removing nuts. Snub-seat design provides greater holding power.
Anderson Electric Co, Birmingham, Ala.

(*More New Equipment on page* 97)



Photoelastic Test—Inside story of stresses on turbine blades

The entire industry benefits from Westinghouse plowback of earnings

RESEARCH CREATES BREAKTHROUGHS

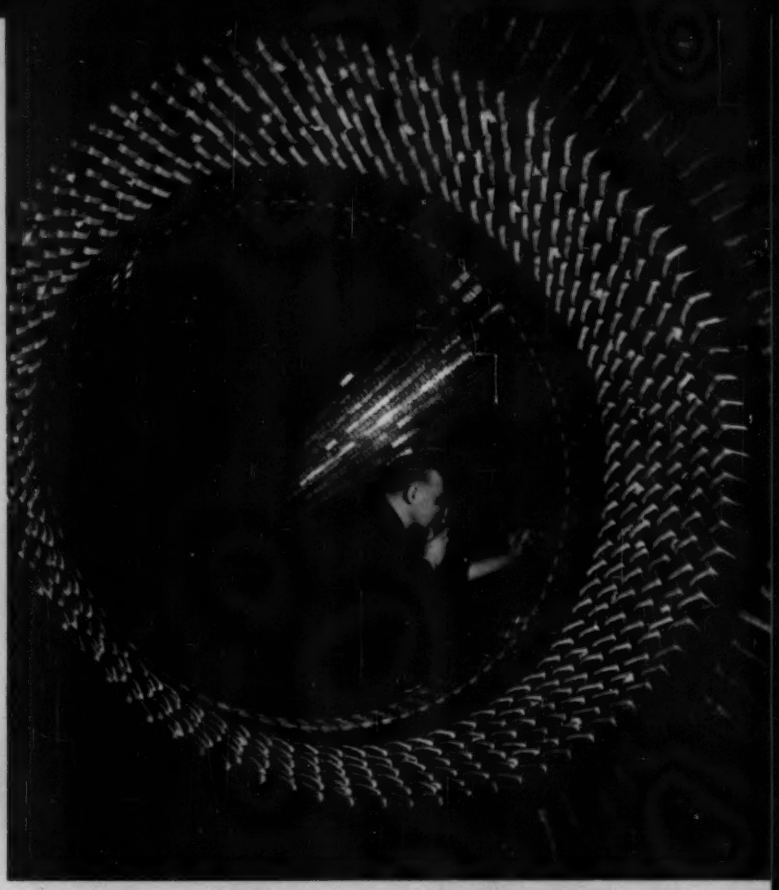
TO NEW KNOWLEDGE, BETTER PRODUCTS

Fantastic load growth is projected for the next 10 years, 20 years, 30 years. The nation's electric utilities will meet it. What are the problems facing the industry? Bringing high voltage close to load, controlled dispatching; in generation—temperature, pressure, vibration, approach to theoretical limits of existing equipment, and a host of others. Out of this maze of interrelated problems, Westinghouse is bringing new products, new systems, new ideas to meet the many future needs of the electric utility. Westinghouse considers this program its obligation to the industry . . . an obligation fulfilled only by a broad policy of reinvestment of earnings into research and development.

New Westinghouse
Research Laboratories

YOU CAN BE SURE...IF IT'S Westinghouse

1. From 19 years' research . . . Thermalastic coil insulation, most stubborn insulation known



2. From a basic knowledge of metals and vibration . . . research with rifle accuracy

4. Electro-negative gas sponges up arcs

3. Making small molecules out of large ones cuts dry-type distribution transformer size up to 50%

6. At Materials Engineering, sureness is designed in

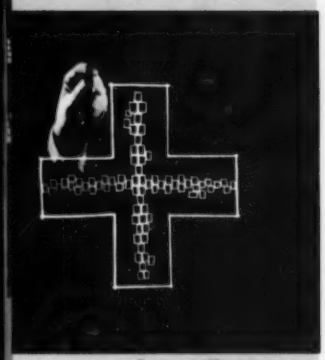
HERE IN THE WESTINGHOUSE RESEARCH LABORATORIES

1958 was years ago

PLOWBACK OF EARNINGS PRODUCES RADICALLY NEW METALS, INSULATION, PROCESSES

Only one development in five from Westinghouse research is the result of a single science. Not only teams of scientists, but teams of sciences are today discovering new knowledge, channeling it toward practical applications of tomorrow.

Westinghouse fundamental research is a panoramic approach to solving the problems of the electric utility industry and to achieving the long-term objectives that underlie them.



5. In metallurgy . . . magnetism turns a corner

7. New metal alloys from formula to pilot-scale production

1. FROM 19 YEAR'S RESEARCH . . . THERMALASTIC COIL INSULATION, THE STUBBORNEST INSULATION KNOWN

What is it? An overlapping barrier of large mica splittings locked into a memory-type resin bond. It's thermally stable. Chemically inert. Rejects moisture. Won't embrittle. Stays elastic. Hugs the copper to which it is applied. Its reliability is proved by 40 million kva in service—on large motors and generators.

2. FROM A BASIC KNOWLEDGE OF METALS AND VIBRATION . . . RESEARCH WITH RIFLE ACCURACY

Problem—higher and higher pressures and temperatures, steam flowing through turbine blade paths at greater speeds. At the research center, mathematicians determine stresses; physicists make models of molecular structure of an alloy, recently created a new alloy, Nivco, testing at 100,000-psi tensile strength at 1200°F. This means that from Nivco will come more efficient turbines.

3. MAKING SMALL MOLECULES OUT OF LARGE ONES CUTS DRY-TYPE TRANSFORMER SIZE UP TO 50%

Remarkable solventless silicones, industry's newest high-temperature, high-voltage impregnants, lead a double life. Silicones in viscous form, with giant molecules, barely flow; their function is to stay put, hold mica flakes together. Fluid (right-hand flask) silicones' small molecules penetrate thoroughly and then form void-free solid insulation to stand heat better. Result—product size cut drastically.

4. ELECTRO-NEGATIVE GAS SPONGES UP ARCS

Presently applied on high-voltage switches, sulfur-hexafluoride is one of the most effective arc-interrupting agents known. In the test shown here, a 10-kv arc in the horizontal tube of air is instantly quenched when injected with SF_6 gas.

5. IN METALLURGY . . . MAGNETISM TURNS A CORNER

Cubex®, a newly developed alloy, breaks through a long-standing magnetic barrier, promises significantly improved performance of motors, transformers and other apparatus. The metal crystals are aligned in ice-cube fashion so that magnetism readily flows in four directions instead of two, turns corners with less resistance.

6. AT MATERIALS ENGINEERING, SURENESS IS DESIGNED IN

In the Materials Engineering Departments, research discoveries are transformed into practical engineering form. Projects are then turned over to operating divisions for application. An example is the procedure developed by Materials Engineering for ultrasonic testing of rotors and spindles. This procedure has contributed heavily to the unexcelled record for dependability of Westinghouse turbine generators.

7. NEW METAL ALLOYS FROM FORMULA TO PILOT-SCALE PRODUCTION

Bridging the gap between initial development and mass production is Blairsville . . . completely equipped for metals analysis and pilot-scale production. Nivco, alloys for atomic energy equipment and other metals used throughout the company are being developed here.

YOU CAN BE SURE . . . IF IT'S

Westinghouse

Curiosity in depth . . .

FROM 6000 ENGINEERS AND SCIENTISTS AND 200 LABORATORIES COME NEW KNOWLEDGE, NEW PRODUCTS, NEW SYSTEMS

Laboratories in every operating division of the company are continually engaged in both long- and short-range product development and improvement programs. Many of these projects originate at the Research Laboratories, are further developed, designed and tested at the divisions. Most problems directly involved with product improvement are solved with the division's own facilities.

1. $7,500,000 WORTH OF ABSOLUTE QUIET

This is one of the world's largest anechoic half-spaces where complete sound measurements can be made on transformers far larger than any presently in service. With the help of this multimillion-dollar facility, transformers of the future will be smaller, lighter, quieter, more economical.

2. PUTTING THE PRESSURE ON GAS TURBINES AND COMPRESSORS

The variable density wind tunnel helps create vital design advances. It tests model blade profiles and paths under all operating pressure conditions. Highly loaded gas turbines can also be investigated. The most promising designs are selected for full-scale testing in high-power rigs.

3. $6,000,000 INVESTMENT IN ADVANCED TURBINE DEVELOPMENT

Through the work done at the new development laboratory, the Steam Division is now building the world's most efficient and one of the largest turbine generators, for 5000 psi 1200°F, the most advanced steam conditions now planned. Development work at the lab ranges from bearings to complete blade paths.

4. ONE TURBINE DEVELOPMENT CAN SAVE A UTILITY UP TO $450,000

In a 200,000-kw generating plant, 1% improvement in heat rate can, depending on fuel cost, justify a utility capital investment of up to $450,000. Photoelastic test of a new blade root shows stress concentration under simulated operating conditions. Tests like this lead to an array of turbine developments, providing increases in efficiency and savings to utilities.

5. FIVE MINUTES TO A BETTER TRANSFORMER

Power transformer design time has been drastically reduced by this IBM 705 computer, freeing engineering time for the creative development of tomorrow's transformers.

6. SEVEN VEILS AGAINST WEATHER

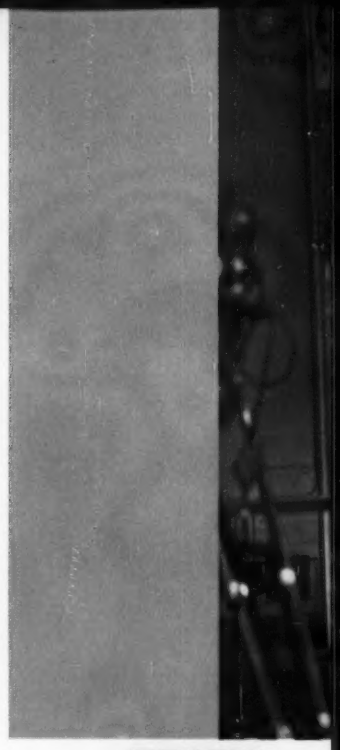
A half-million-dollar investment has created seven modern laboratory facilities for development of watthour meters at the new Raleigh plant—chemical, metallurgical, environmental, life test, mechanical, analysis and electrical development. From the chemical lab, for instance, come new organic and inorganic finishes for protection against everything from salt spray to ultraviolet light.

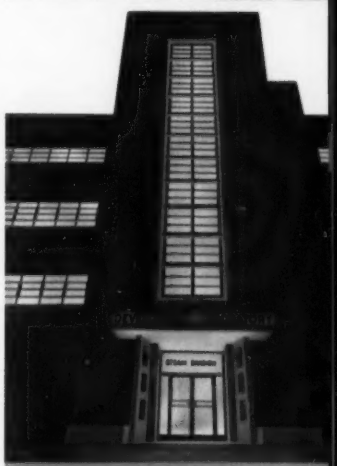
7. 5,200,000-VOLT SKYSCRAPER

Used in the verification and testing of new insulation systems for transformers, this surge generator is constructed from 104 100-kv capacitors in layers to a height of 52 feet. This unique design tool is part of the ultramodern transformer research and commercial testing laboratory.

8. THREE BILLION VOLT-AMPERES OF SURENESS

With capability to duplicate virtually every known system characteristic under controlled conditions, the High Power Laboratory has proved to be the industry's most valuable single design tool. For over 32 years, the capability and availability of this facility have fostered designs which have saved utilities millions of dollars.





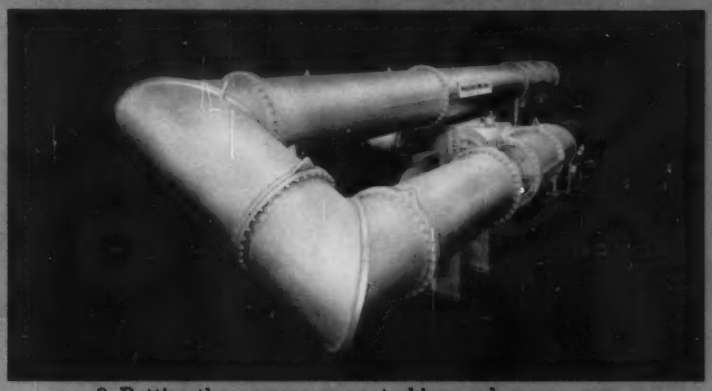
3. $6,000,000 investment in advanced turbine development

6. Seven veils against the weather

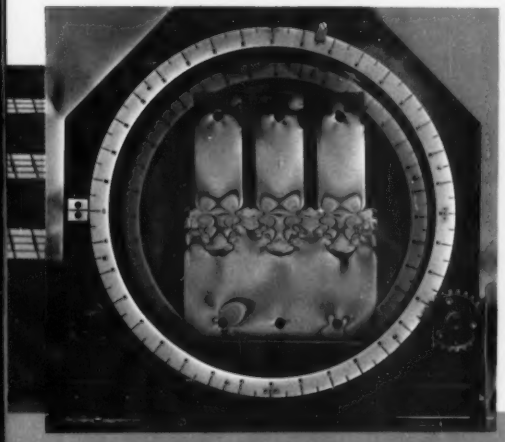
YOU CAN BE SURE...IF IT'S

Westinghouse

1. $7,500,000 worth of absolute quiet



2. Putting the pressure on gas turbines and compressors



4. One turbine development can save a utility up to $450,000

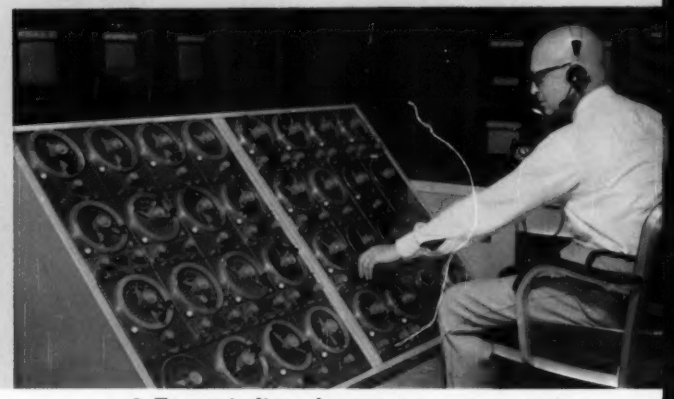
5. Five minutes to a better transformer

7. 5,200,000-volt skyscraper

8. Three billion volt-amperes of sureness

1. Out of snow and rocks . . . a laboratory

2. How to climb a mountain in total dark



3. Economic dispatch computer . . . nerve center of West Penn Electric interconnected system

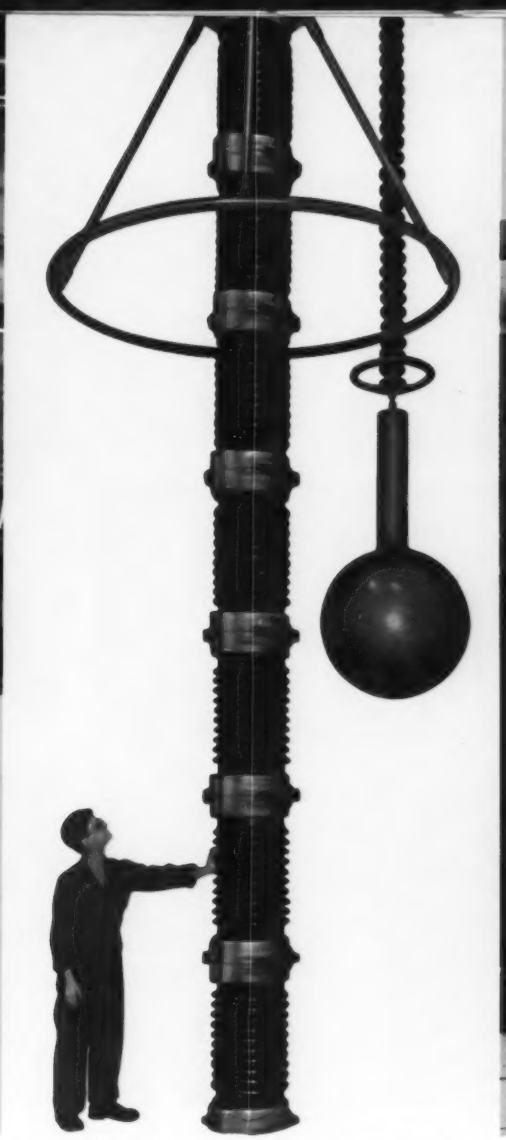
Plowback creates breakthroughs

TO HELP UTILITIES PLAN FUTURE SYSTEM COORDINATION AND ECONOMICS

A broad area of communications at Westinghouse, helping the industry plan, evaluate, test and apply new ideas and systems, is the Electric Utility Engineering Department. Within the department's engineering groups, for example, sponsor engineers, assigned to utilities in specific areas of the country, review broad application and engineering problems and direct studies for their solution. Other electric utility engineering groups are assigned to specialized problems and long-range studies advancing the fields of generation, transmission and distribution. Service engineers and consulting and application engineers provide a strong right arm in the field. These groups apply both a broad knowledge of the industry and specialized experience to your problems of today and to your objectives for the future.

1. OUT OF SNOW AND ROCKS . . . A LABORATORY

Broadening the test program that began with A.G.&E. at Tidd Station, an extra-high-voltage test transmission line has been built at 10,000 feet elevation in the Rockies in cooperation with Public Service Company of Colorado. For the specific purpose of measuring corona and radio influence especially under violent extremes of weather, voltages ranging from 173 to 500 kv are being investigated. Knowledge gained here will shorten the road



5. A five-state power network in one room

4. How lightning arresters keep ahead of lightning

to economical transmission of large blocks of power at super voltages, will help assure the equipment to handle it.

2. HOW TO CLIMB A MOUNTAIN IN TOTAL DARK

Automex—or automatic experimenter—could solve this kind of problem, if turned loose on it. At Westinghouse, its job is to reach a control objective when complete knowledge is not available. A general purpose automatic control, this machine studies problems, profits from its own mistakes. As part of an automation system, Automex may one day run an entire chemical plant or paper mill.

3. ECONOMIC DISPATCH COMPUTER . . . NERVE CENTER OF WEST PENN ELECTRIC INTERCONNECTED SYSTEM

Trends toward integration of whole power systems and interchange between systems put a premium on precision and speed of dispatching. The Westinghouse computer determines the most economical output of all generating stations automatically, specifies correct spread of load, greatly simplifies dispatchers' problems.

4. HOW LIGHTNING ARRESTERS KEEP AHEAD OF LIGHTNING

This SVS station arrester, even after 1200 lightning surge tests at the Switchgear Division, shows no change in performance characteristics. Improved Autovalve® arrester blocks, rigid production quality control, continuous high-voltage surge testing have produced designs reducing arrester discharge voltage by 20% in recent years.

5. A FIVE-STATE POWER NETWORK IN ONE ROOM

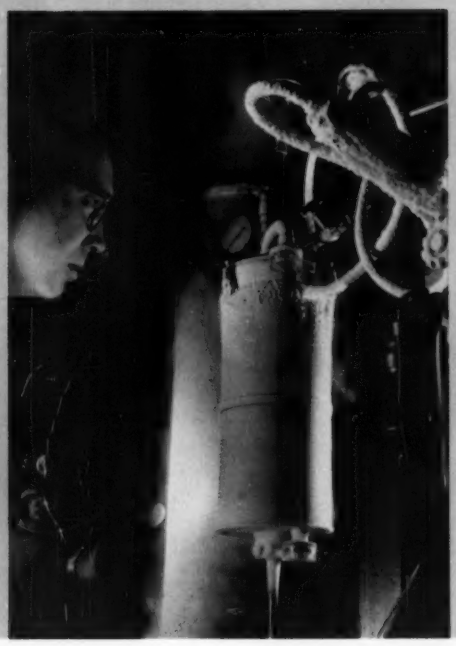
Here is the world's largest a-c network calculator, with 36 generating stations, 580 circuits, capable of simulating the largest power systems. System planning in the fields of voltage regulation, stability studies, short circuit analysis and many others has been an enormous timesaver to hundreds of utility engineers who have used this facility and who are welcome to do so.

YOU CAN BE SURE...IF IT'S Westinghouse

1. From Westinghouse will come the next "first" in atomic power

3. Super-pure... they count the molecules

2. Perpetual power at 450°F below zero



MADE POSSIBLE THROUGH WESTINGHOUSE REINVESTMENT OF EARNINGS...

Ideas in research discipline the unknown

Research at Westinghouse is a vast quest for new knowledge. The electric utility industry has in the past benefited heavily from Westinghouse research. The industry is continuing to benefit—in money saved, in hours and years saved, in goals achieved—and will into the future. This is because Westinghouse is continuing to pour energy, imagination, talent, money into extensive programs of research.

1. FROM WESTINGHOUSE WILL COME THE NEXT "FIRST" IN ATOMIC POWER

The Westinghouse Testing Reactor will generate answers, not line kilowatts. This facility, under actual conditions of irradiation, temperature and pressure, will evaluate fuel elements and reactor equipment. Knowledge of nuclear technology gained here will enable utilities to produce commercial atomic power sooner and at lower cost.

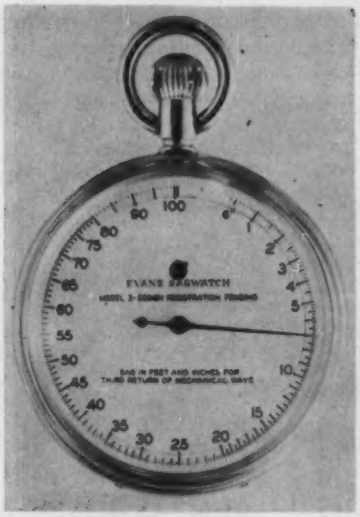
2. PERPETUAL POWER AT 450°F BELOW ZERO

At temperatures such as this, many metals lose all measurable resistance, become perfect diamagnets, circulate induced electric current in a closed system—apparently forever. What will come from this superconductor development? Can electric power be stored? Will current in the future be transmitted over tiny wires instead of cable?

3. SUPER-PURE . . . THEY COUNT THE MOLECULES

The process is known as cage-zone refining, achieving metal pure to a few parts in a billion. Material being melted acts as its own crucible. The bar is melted progressively end to end, drawing impurities in one direction. Semiconductors now. In the future, a procession of useful developments will come from this basic work at Westinghouse. CP-1047

YOU CAN BE SURE...IF IT'S Westinghouse



Sag Indicator . . .

. . . measures wire sag directly in feet and inches with accuracy of 1%. Applicable to any wire, regardless of span, tension, or type and size of conductor, the Model 5 requires no target boards, charts, or tables. Logarithmic dial measures sags up to 36 ft, based on the fifth return of a mechanical wave. It is particularly suitable for smaller wire, where high precision in sagging is desired.
Kirk Dial & Crystal Co, Seaboard Bldg, Seattle, Wash., or **Webb Dial & Crystal Co, 576 Seymour St, Vancouver, B. C., Canada.**

Network Protector Tester . . .

. . . for field use on systems up to 480 v, 50 to 60 cps, tests both over-all operation and individual parts. It can also be used for making complete relay settings, including

Is YOUR Brush Control Problem "Different"?

WHATEVER YOUR PROBLEM, YOU'LL FIND THERE'S A

WEEDONE®

BRUSH KILLER

specially designed to do the job

Chemical control of brush—for line and roadside clearance and other purposes—has come a long way in a few short years. Weedone Brush Killers, originated by the American Chemical Paint Company, were the pioneers in chemical brush killing. Now immensely diversified, these fine products are still the leaders in the field. Today there is a Weedone Brush Killer specifically formulated for practically every need. Each is selective, effective, completely reliable.

Whatever your brush control problem, there is a Weedone Brush Killer of superior quality

- for practically every purpose
- for every condition of use
- sure in its kill of even the toughest weeds
- laboratory tested
- field proved over thousands of miles of rights-of-way
- economical to use

Write for Weedone Brush Killer folders and full information.

AMERICAN CHEMICAL PAINT COMPANY
Agricultural Chemicals Division
St. Joseph, Mo. • AMBLER, PA. • Niles, Calif.

WEEDONE ACP WEEDONE

Originators of 2,4-D and 2,4,5-T Weed and Brush Killers

The design work on all these new substations is going to be hard to handle with our present force.

Of course! They have enough to do handling routine duties. Why don't you call in PIONEER?

GIVE YOUR NON-ROUTINE OPERATIONS TO PIONEER

Design and Consulting Engineering Services

Pioneer has specialized in designing power plants for 56 years. It offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and in supervising construction. Pioneer's other services include substation, transmission and distribution studies and design.

Services in Regulatory Matters

Pioneer offers its services in all phases of Federal, State and Local regulation including the rate base, depreciation analysis, cost of service studies, market analysis, certificate proceedings and rate of return.

Corporate Services

Pioneer's services in corporate matters include business and management engineering advice, financial, accounting and tax counsel and insurance and pension plans and programming. It maintains a complete stock transfer, ledger and dividend disbursement service.

NEW! On your letterhead, write for 40-page booklet, "Pioneering New Horizons in Power". Describes, illustrates Pioneer's engineering services, and corporate services, from financing to operation.

56 YEARS

Pioneer Service & Engineering Co.

231 South La Salle Street
Chicago 4, Illinois

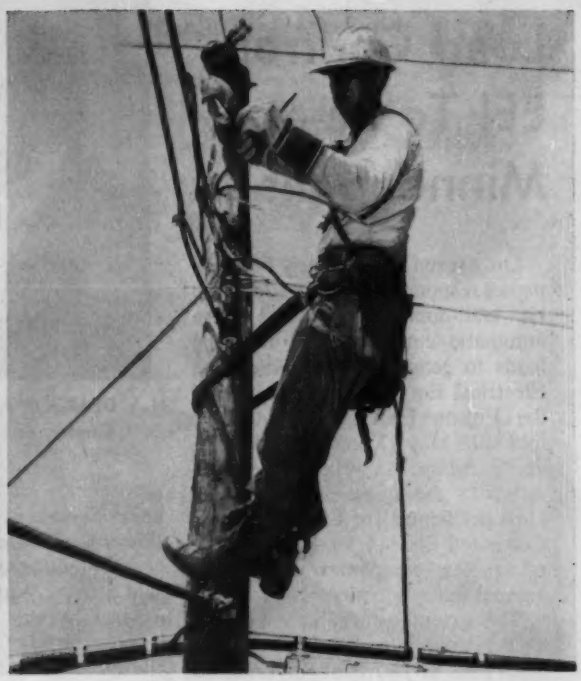
reverse current and overvoltage closing on the master relay and overvoltage closing on the phasing relay. Time delay and instantaneous calibration can be made on protectors with desensitizing relay.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Illumination Control . . .

. . . features automatic, positive control of light switches, with no power consumption except during 30-sec switching cycle. Designated Model 1099, this luminaire control has compact, plug-in design. Replacements can be made without recalibration or adjustment of controls. At working levels, spectral response of Photronic cell approximates that of human eye, eliminating effect of outdoor color temperature. It is available in enclosed or uncovered types and can be equipped with internal lightning arrester.
Weston Instruments Div, Daystrom, Inc, 614 Frelinghuysen Ave, Newark, N. J.

Large Fuse Links . . .

. . . for 2,400-v transformers above 25 kva are rated 14, 21, 32, and 46 amp. SloFast links have two fusible elements: A fast, conventional element for protection against primary bushing and winding failures; and a slow element whose characteristics follow ASA transformer-safe-loading curves, to guard against secondary short circuits and overloads.
A. B. Chance Co, Centralia, Mo.



Cable is a continuous run from the pole to the meter with no splices or taps. Because installation is quick and simple, the Company now strings 30-50% more services per day.

FOR RESIDENTIAL SERVICE

Kansas City Power & Light uses neoprene drop cable to speed installations, reduce contact danger

A single cable called the "Kansas City Service Drop" solved pole-to-home installation problems for Kansas City Power & Light Company. It is made of two hard-drawn aluminum conductors covered with Du Pont neoprene, and wrapped in aluminum ribbon which forms the cable jacket and acts as the neutral.

This attractive cable is made in easy-to-install small diameters. It withstands extremes of heat and cold. It reduces contact hazard to employees and customers; eliminates power theft; is easier to string through trees. The sawing action of the cable's concave aluminum ribbon makes it generally self-clearing.

Will it hold up? In a dielectric moisture test, one sample of cable immersed in water 2 days lasted as long as a dry sample. Both broke down at 21,000 volts. And when a recent tornado hit a Kansas City suburb, some of the cables in its path were whipped to the ground but were still in condition to deliver service.

This utility has 6 million feet of neoprene-covered cable in the air. And they're buying an added million feet a year. Neoprene's long-term reliability earned this confidence. Of all resilient materials, only neoprene offers balanced resistance to sunlight and weather, heat, chemicals, abrasion and cutting, flex cracking, aging and oxidation.

Ask your supplier about wire and cable jacketed with neoprene. It's available in single and multiple conductor types and voltage ratings to meet your requirements. Mail the coupon below to get the ELASTOMERS NOTEBOOK with actual on-the-job reports of neoprene's performance in a wide range of industrial products.

DU PONT

Better things for better living
... through chemistry

NEOPRENE
— made by Du Pont for 25 years

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. EW-6
Wilmington 98, Delaware

Please put my name on the mailing list for the Elastomers Notebook.

Name_____
Position_____
Firm_____
Address_____
City, State_____

MAIL THIS COUPON NOW... WHILE YOU'RE THINKING ABOUT IT

Load Control EEI Topic at Minneapolis

H. E. DEARDORFF, retiring chairman, Electrical Equipment Committee, vice president, Dayton P&E, passes gavel to successor, D. W. Taylor, Public Service E&G

Only seven of the nearly 60 companies responding to a questionnaire on load-dumping practices have automatic equipment for reducing loads to generator capabilities, the Electrical Equipment Committee of the Edison Electric Institute was told at its May 13 meeting in Minneapolis, Minn. In reporting on answers to the questionnaire, V. J. Hayes, Connecticut Light & Power Co, noted that 44, or 86%, of the responding companies depend on manual load reduction.

The extent to which companies would dump load varied almost from zero to 100% of the total, he said, adding that 16 companies make it a practice to request selected customers to reduce demand, 17 dump selected customers manually, and another 17 drop feeders.

K. M. Smith, Commonwealth Edison Co, said that in recent years it has become necessary to plan system reactive supply just as it was always necessary to plan kw supply. He suggested ways of planning the system as a whole.

Cross-loop transmission ties are being developed by Northern States Power Co to strengthen system supply and reduce reserve requirements, said Seth N. Witts. The basic transmission system, started at 69 kv, is now mostly 115 kv, said Witt, who added that he anticipates early construction of 230-kv lines.

Northern States Power and Cincinnati Gas & Electric Co inspect and test new transformers to detect shipping damage, reported H. P. Bruncke and F. W. Rempe Jr of those power companies, respectively. Transformers in service, they said, are inspected periodically and oil tests are made. Oil is reclaimed when tests indicate it is needed.

Unit generator design, used with isolated-phase bus duct, is a feature of Oak Creek Plant, according to N. A. Ricci, Wisconsin Electric Power Co. Generators, he said, have two shaft-driven exciters each, a starting and emergency exciter. An automatic transfer scheme changes from normal to emergency excitation. As this arrangement has proved complicated, he said, the next unit will have excitation provided from a motor-generator set.

At the plant, generator transformers are water cooled, turbine condensate being used as cooling water, he said, adding that piping transformer oil into the building has eliminated its freezing.

J. H. Vivian, Southern California Edison Co, reported that bushing standard ASA C-76.1A is in print.

Purchasing Agents Discuss Cost Cutting (*Continued from page* 60)

buys the equipment from a dealer. The concern borrows from a bank to pay for the vehicles and assigns title to the vehicle to the bank. The lessee pays for the use of the bank's capital plus a fee to the leasing company. When the vehicles are disposed of, the lessee sells the car or other equipment and the proceeds are credited against the capital expenditure made to the bank. In this type of leasing the lessee provides the driver, and all maintenance and operating expenses.

Thus the only real difference between owning the vehicles and leasing them lies in the financial transaction involved and not in any way to operation except for some intangibles such as how often to change the oil and extension of manufacturers' guarantee periods.

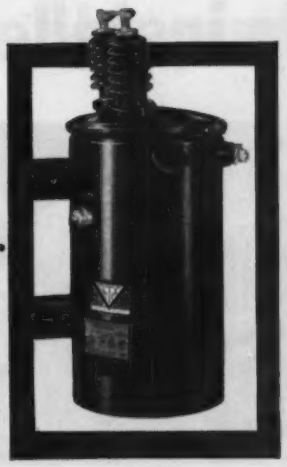
Among the advantages of this type leasing according to Hogg are: 1. Average first cost of cars or equipment is reduced; 2. Trade-in value is increased; 3. The cost of money is lower; 4. Capital is freed for other purposes; and 5. Rental costs are fully tax deductible.

Hogg concluded: 1. The longer the life of the vehicle or equipment the less the leasing advantages tend to be, and 2. Any company thinking seriously about leasing should make an accurate cost study disregarding theoretical advantages and disadvantges and compute the actual dollars they would be ahead or behind in say a ten-year period.

In keeping with the cost-cutting theme of the PA meeting J. E. Longyear of Detroit Edison and W. Marks of Commonwealth Edison presented dual papers on "Inventory Control Systems Mechanized" as practiced in their respective utilities. Both pointed out that the object of mechanized systems is to properly control inventory investment and its attendant overhead costs. Both also agreed that while mechanized systems have come a long way there is still much more to be done in this area.

Vendor Delivery Problems by R. Gear, Commonwealth Edison were reported in EW on June 2, p 43.

plan for the future ✳ plan to use RT&E Dual Voltage Transformers NOW!



up-rate system voltages

faster, easier, more economically

You can now look ahead and plan, with complete assurance, a relatively simple and economical way to increase system voltage. The development of the R T & E Dual Voltage Transformer makes this advance planning possible. You save on stocking, since one unit takes the place of two. You save on obsolescence when system voltage is uprated. Save on personnel needed for cut-over work.

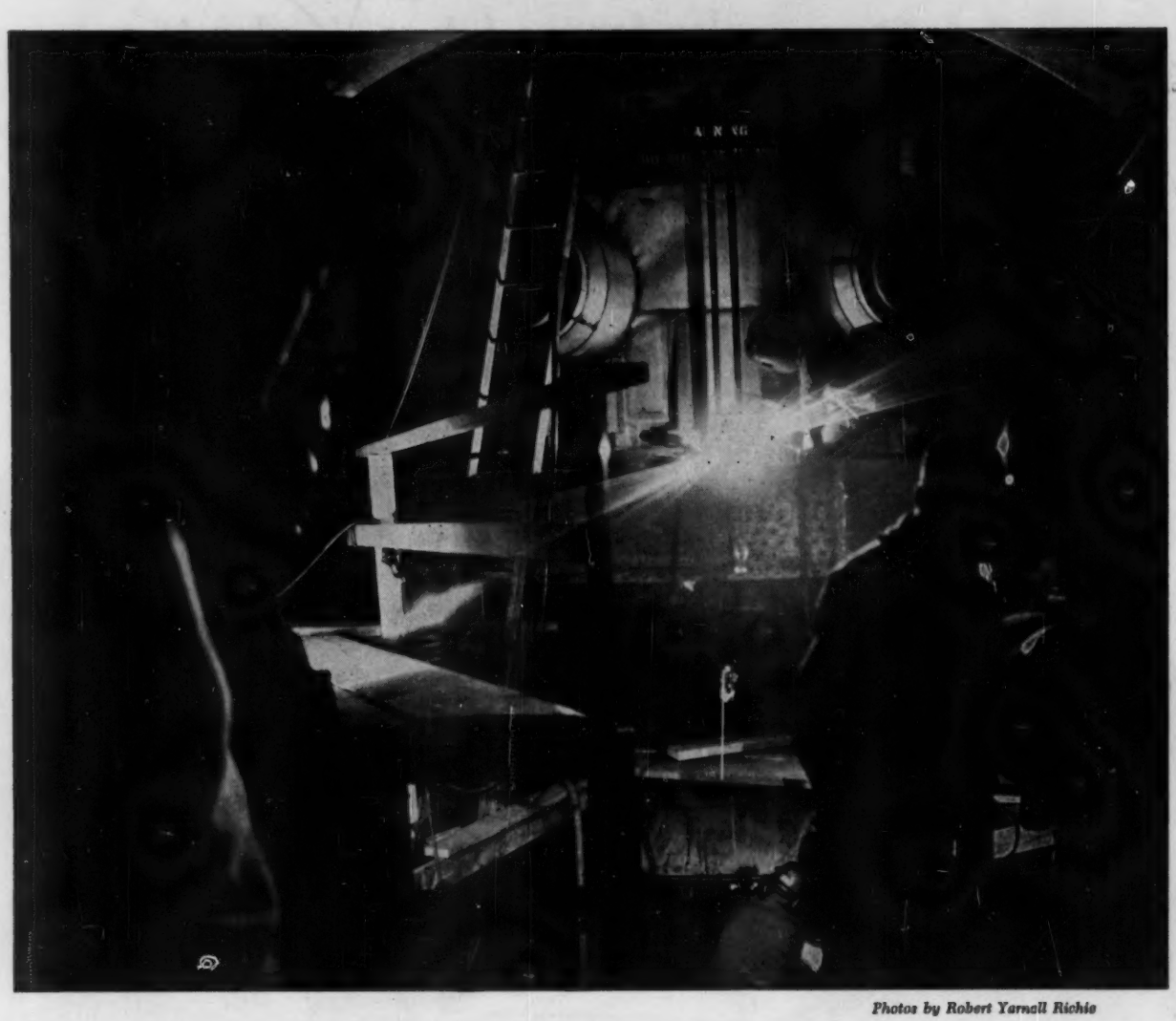
Externally operated primary voltage change-over switch means instant voltage change, saving down time and labor time. No tank opening required, no bolted connection changes. No interruption of service; you cut over larger areas faster.

Available with all primary voltage combinations: 2400 x 4800 volts, 2400 x 7200 volts, 7200 x 14,400 volts, 4800 x 14,400 volts. Or custom designed to meet special voltage requirements. Prices for the R T & E Dual Voltage Transformer are only slightly higher than conventional single voltage transformers.

Concentrated Engineering Talent Makes One Product Better

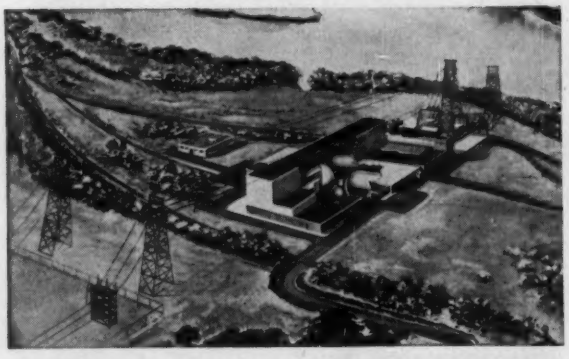
RT&E CORPORATION

WAUKESHA, WISCONSIN • PORTLAND, OREGON



Photos by Robert Yarnall Richie

Rome's station control cable installed



Artist's Sketch of first U. S. full-scale atomic-electric plant. This revolutionary power plant—under the operation of Duquesne Light Company of Pittsburgh—delivers electricity to home and industry in the Pittsburgh area.

Atomic-Electric Power is controlled from this large cabinet installation at the Shippingport atomic power station. Nearly ten miles of Rome's highest quality station control cable are used in this vital system.

Partner to the Atom. Rome's control cable is here being installed in the nation's first major atomic power plant at Shippingport, Pennsylvania. Rome Cable furnished over 50,000 feet of station control cable for this important installation.

in Shippingport atomic power station

This country's first full-scale atomic power plant for the generation of electricity contains almost ten miles of Rome's highest quality station control cable.

The selection of Rome's Rozone-Roprene cable—with a special over-all asbestos outer braid—for this epoch-making installation was no accident, for individual Rozone insulated-Roprene jacketed conductors represent the ultimate in control cable design and performance.

Advantages of Rozone insulation. Rozone—a high-quality oil-base compound—is an excellent insulation. Long and widespread experience has proved that its high-dielectric and impulse strength, combined with its resistance to corona and ozone cutting, makes it an ideal insulation for control and high-voltage power cables. Its electrical properties are practically unaffected by long-time immersion in water or burial in the ground.

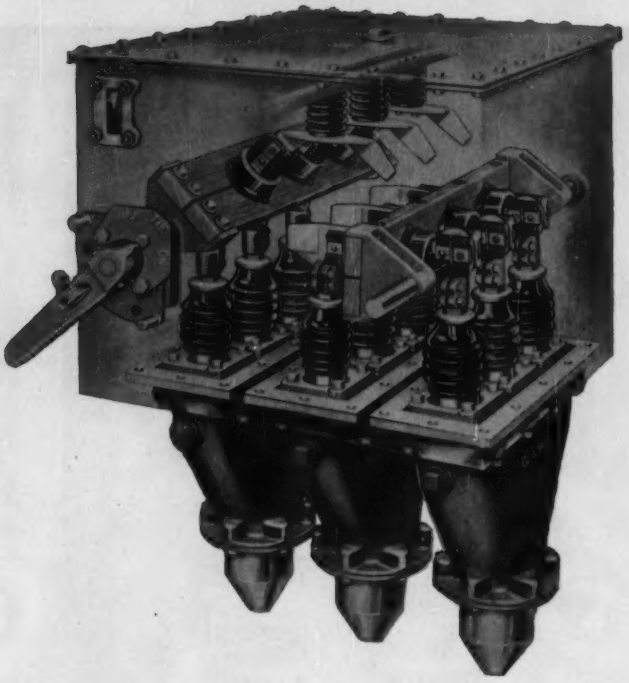
Advantages of Roprene jacket. Roprene—a neoprene synthetic rubber compound developed by Rome Cable—provides an extremely durable and permanent mechanical protective covering for the individually Rozone-insulated conductors. It assures terminations that are resistant to abrasion, weather, and attack by chemicals and oils. And it is exceptionally resistant to fire.

Additional fire protection for this particular cable included a special over-all asbestos outer braid.

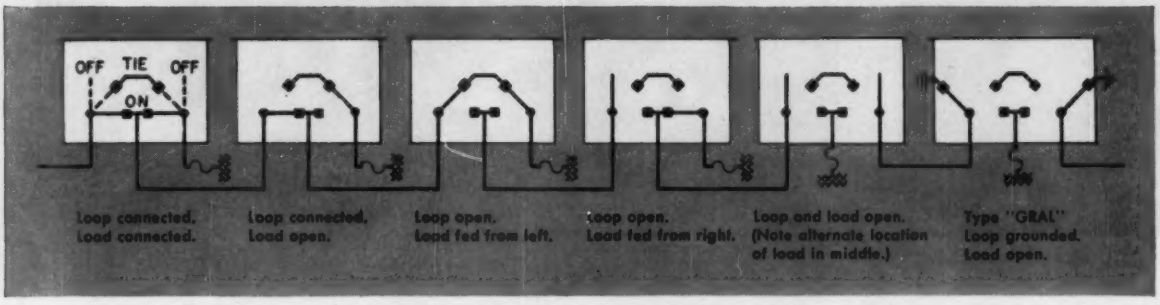
Specify premium-quality Rozone-Roprene control cable for your next job. Contact your nearest Rome Cable representative for more information—or write to Department 802R, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION



low cost, unexcelled system flexibility


OFF
TIE
ON
OFF
Loop connected. Load connected.
Loop connected. Load open.
Loop open. Load fed from left.
Loop open. Load fed from right.
Loop and load open. (Note alternate location of load in middle.)
Type "GRAL" Loop grounded. Load open.

VOLTAGE CHARACTERISTICS

voltage rating	60 cycle withstand dry	impulse withstand 1½ x 40 wave
7.5kv	36kv	95kv
15.0kv	50kv	110kv
23.0kv	70kv	150kv
34.5kv	95kv	200kv

CURRENT CHARACTERISTICS

ampere rating	switch	amperes	
		momentary	4 seconds
400	standard	20,000	15,000
	special*	30,000	19,000
1000	standard	40,000	35,000
	special*	50,000	40,000

standard contacts silver plated
*silver inlaid contacts

Where maximum flexibility is demanded in a distribution system, the Type RAL oil switch has no equal. A few of the connections made possible with it are shown above.

The RAL load break oil switch is designed for three ways (two feeders and one load). The ways, links and tie buses are so compactly combined that only one RAL switch is needed to do the job of three conventional type switches. Costs are reduced accordingly—for equipment, installation time and space requirements. Maintenance expense is always far less for a quality product, too.

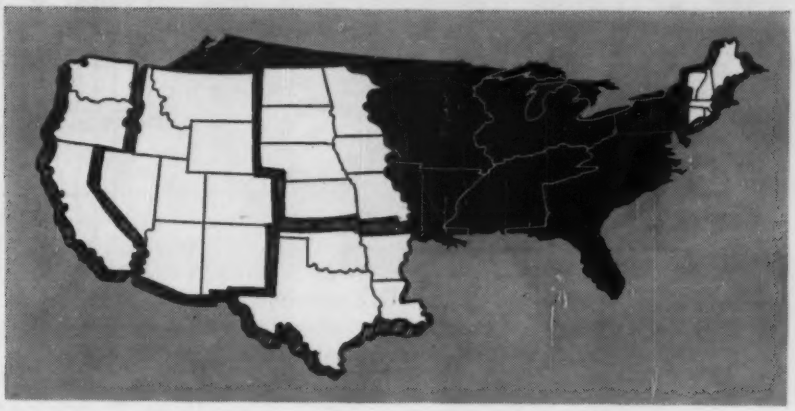
Standard RAL switches are made in 400 ampere (full load break) rated 600 volts, 7.5 kv and 15 kv. Special designs are made for 23 kv and 34.5 kv and for 1,000 amperes.

You can't afford to overlook the opportunity to learn more about this G&W switch. Contact a G&W representative about it today.

G&W ELECTRIC SPECIALTY COMPANY
3500 W. 127TH STREET • BLUE ISLAND, ILLINOIS

CANADIAN MFR. • POWERLITE DEVICES, LTD. • TORONTO, MONTREAL & VANCOUVER

D584



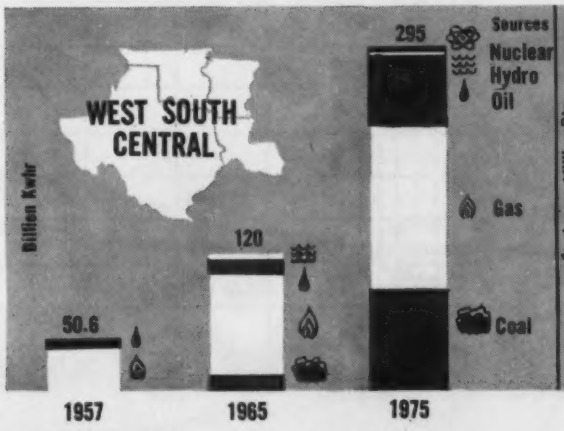
Report on
Fuel Outlook III

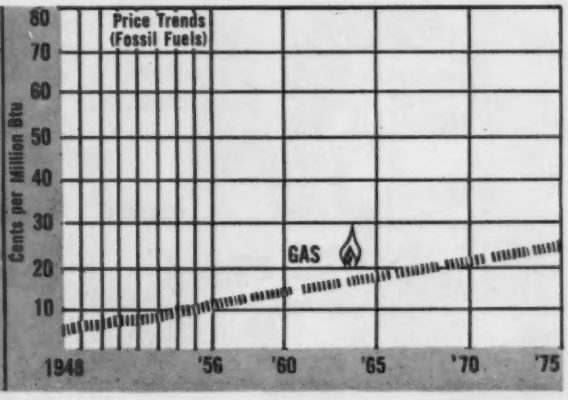
King Coal Extends His Realm

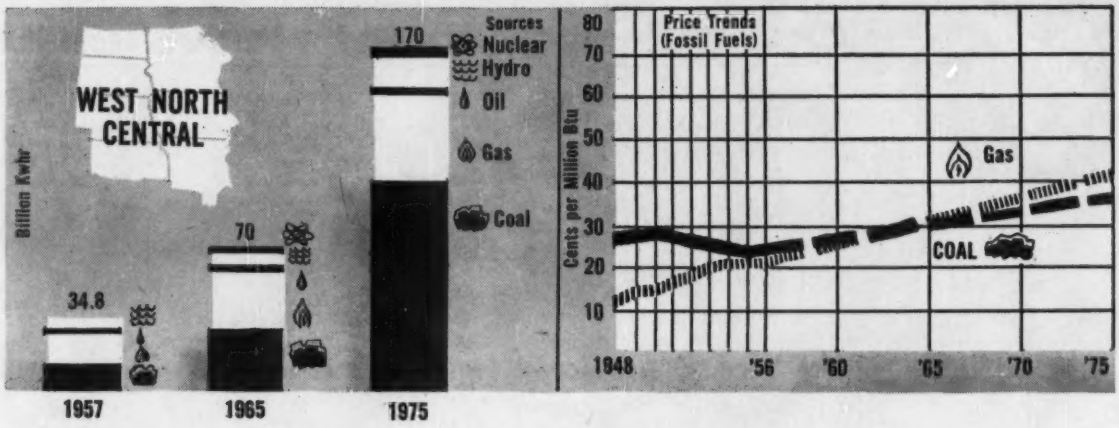
Today in five regions of the U. S., coal faces stiff competition as a source of electric generation. In two of them, utilities now burn scarcely any coal at all. But by 1975, King Coal will have spread his frontiers from coast to coast. Here's the story of his expected progress in the five competitive regions—plus a tabular summary of utility energy sources in 1965 and 1975.

I. West South Central: Coal Gets a Foothold

The West South Central Region has long been a one-fuel region; and with gas prices in the neighborhood of 10¢ per million Btu, it is not hard to see why. But future demands will be too great for a premium fuel to meet, and coal will probably fill the gap. Some companies here indicate that coal may account for from 50 to 70% of their fuel requirements 20 years from now. Two utilities in this gas stronghold hint they may burn some coal by 1963. And most new plants in the area are designed for future burning of coal. Altogether, coal will probably account for nearly ⅓ of total generation by 1975.







II. West North Central: 60% Coal by '75

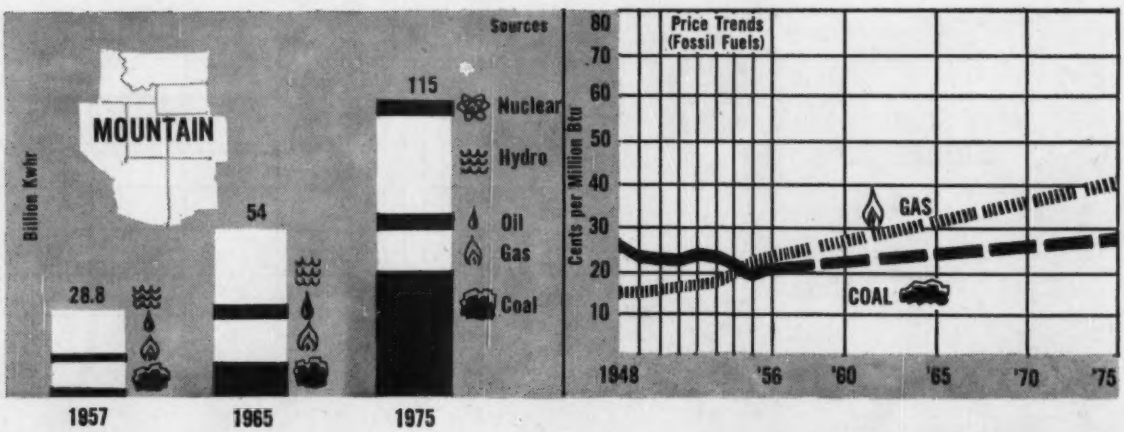
Competition in the West North Central Region is between coal and gas. On a yearly average basis, gas is still the cheaper of the two. But the trends of their costs are fast approaching a crossing, which may occur about 1965. Coal's share of generation will increase until it supplies over 60% of the area's energy requirements by 1975.

Gas will remain important, owing largely to the possibility of obtaining it from Canada. There will be only a token amount of nuclear power in the area by 1975, and oil will continue to be insignificant.

Hydro generation will triple, as the numerous sites in the Missouri River and upper Mississippi River drainage areas are developed. But the biggest growth will be in coal-fired generation, particularly after 1965.

III. Mountain: Coal Moves in on Gas

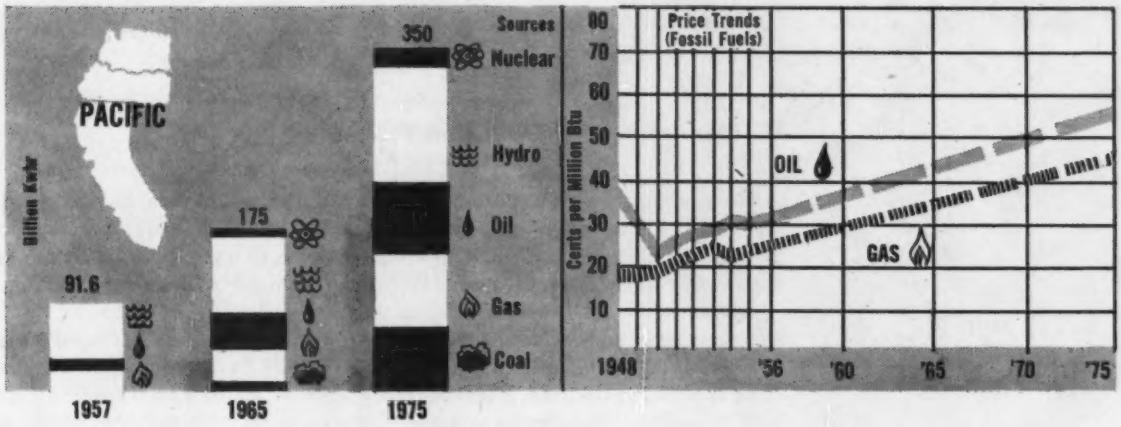
The Mountain Region's fuel picture looks like the West North Central Region's except that here the price of coal is already lower than that of gas. Strip mining costs in Montana have steadily declined in real terms for the past few decades. On the other hand, gas costs have been rising at the rate of 1¢ per year in some



parts of the region. The similarity extends to hydro power: Both regions stand to gain from development of the many potential hydro sites.

Hydro should continue to predominate in the Mountain Region, but coal is making by far the biggest gains. By 1975 hydro could supply about 45% of the area's energy, against 55% today. And if political problems should make this projection for hydro over-optimistic, coal is likely to make up the difference.

Gas has been picking up the burden of growing power requirements; but the Mountain Region contains some of the nation's best coal reserves, and plans are now being made to generate power near the coal mines and transmit it several hundred miles to load centers. In Utah and Colorado, utilities have been building coal-fired steam plants since World War II, and the trend is likely to continue. In Wyoming, two plants using strip-mined, low-grade coal are expected to produce power at prices competitive with the U. S. Bureau of Reclamation's hydro. Arizona and New Mexico utilities have shied away from coal in the past, even though good coal was available to them at fair prices. Recently, however, they have begun to look hard at the fine coal deposits in the Four Corners area, in anticipation of rising gas prices.



IV. Pacific: Hydro's Domination to End

Fossil fuels and nuclear power will end hydro's domination of the Pacific Region in the next 20 years. Hydro power may more than double by 1975, but it will probably not then account for much more than ⅓ of total generation.

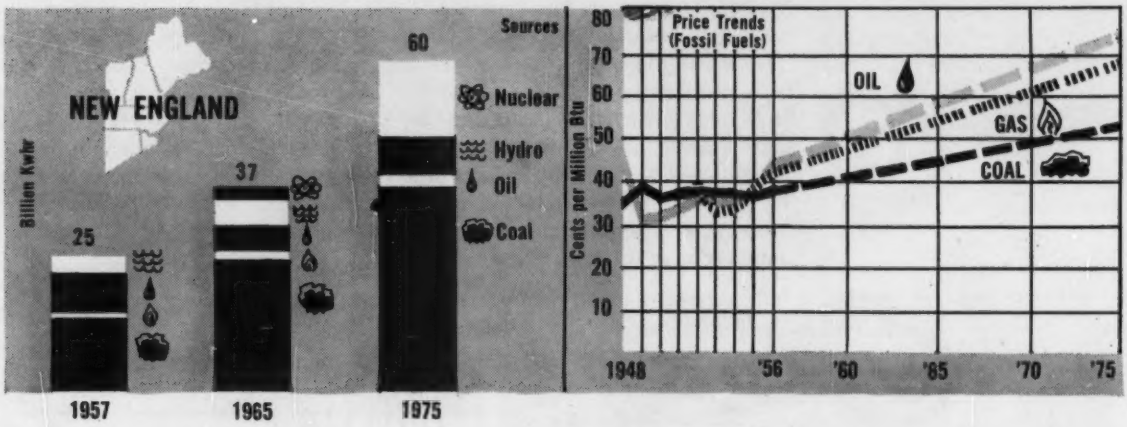
Today's fuel situation is a nip-and-tuck battle between oil and natural gas. Gas offers the best price of the two; but residential use during the winter cuts into the available supply, and utilities turn to oil. Since electric energy demand will more than triple by 1975, it does not seem possible that gas and oil can meet it in view of the other demands for their use.

West Coast utilities will burn all the gas they can get, but even now they are finding it difficult to get enough. Southern California Edison Co is already having difficulties with two major southern California gas companies. Future supplies of gas from Canada will help, but the proposed gas pipelines are needed at least as much to meet consumer demands as to supply boiler fuel.

Coal will fill in—supplying about 15% of generation in 1975. Washington and Oregon are endowed with modest deposits of low-grade coal, and these will find

use in special situations such as Pacific Power & Light Co's Eden Ridge development, where the company plans a 100-Mw coal-fired plant to firm up a 70-Mw hydro plant on the Coquille River.

Nuclear power will make its presence felt in this high cost fuel area, accounting for perhaps 3% of total generation by 1965, as much as 6% by 1975.



V. New England: Coal and the Atom

Coal has already begun to push the other fossil fuels out of New England. For the past ten years, hydro has provided about 20 to 25% of energy needs. The balance has been coal and oil, with a small amount of natural gas. Gas can be discounted for the future, because of the growing demands of premium consumers.

In the past coal and oil have shared the energy market on an almost equal basis, due to near equality in price. But now coal is getting a price edge; and, with this trend expected to continue, it appears that oil use will actually decrease during the next 20 years. Major hydro sites are all but exhausted except in Maine, so no appreciable growth can be expected from that source.

Coal's only important competitor in New England will be nuclear power, which could account for ¼ of the energy produced in 1975. Some recent estimates indicate that a nuclear plant built in 1970 will be economically competitive over its full life. In 1975, however, King Coal will be on top.

Predictions of Energy Sources for Future Electrical Generation (in Billion Kwhr)

	1965						1975					
Energy Source Region	Hydro	Coal	Oil	Gas	Nuclear	Region Total	Hydro	Coal	Oil	Gas	Nuclear	Region Total
New England	5	24	4	2	2	37	6	37	2	0	15	60
Middle Atlantic	15	121	0	0	4	140	22	198	0	0	10	230
South Atlantic	11	118	8	13	0	150	18	265	10	14	13	320
East South Central	18	131	0	0	1	150	20	263	0	0	7	290
West South Central	5	10	10	95	0	120	6	90	50	145	4	295
East North Central	6	271	0	0	2	279	9	555	0	0	6	570
West North Central	7	29	2	31	1	70	15	105	2	44	4	170
Mountain	25	11	3	15	0	54	50	45	3	14	3	115
Pacific	92	8	39	32	4	175	120	54	72	84	20	350
Total U. S.	184	723	66	188	14	1175	266	1612	139	301	82	2400

Build lines to *stay* with the CHANCE 8-WAY

THE EXPANDING ANCHOR WITH ALL 'ROUND HOLDING POWER

All 8-Way Anchor Rods have the Chance-developed Thimbleye that protects your guy strand.

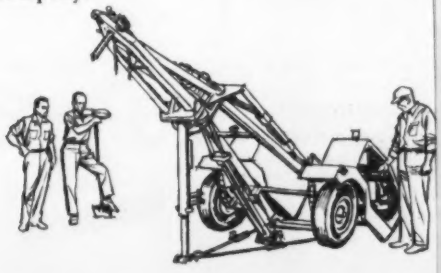
8-WAY EXPANDING ANCHORS FOR STRONGER GUYS · · · Only the Chance 8-Way Expanding Anchor, with its 8 rib reinforced blades, expands into solid earth *all the way around* to form a pyramid-like square.

Chance engineers, who have devoted their careers to developing and testing guying equipment, find that this design adds strength to expanding anchors. The pyramid enlarges the effective area of the anchor's holding power. Blades that expand side by side leave no wasted space between them, can be shorter—less apt to bend, and expand in a wide area of solid earth all around the hole.

That is why field test after field test made for power companies all over the country show that the Chance 8-way usually holds well beyond its rated load, and that is why it is on so many company standards.

Make the Chance 8-way *your* standard for the kind of T and D line guying you can install and forget.

CHANCE FIELD ASSISTANCE AIDS IN ANCHOR SELECTION · · · To assist you in anchor selection, to demonstrate the best installation methods and to test the results under specific soil conditions, the A. B. Chance Co. puts a nationwide team of anchoring experts at your service. These Regional Guying Specialists have the practical experience and technical knowledge to demonstrate proper anchoring to your field men. They have hydraulic testing equipment for on-location field tests to help determine what Chance anchors are right for your system. Call the nearest Chance Regional Manager in your area or ask the Chance Sales Representative to schedule a demonstration for your company.

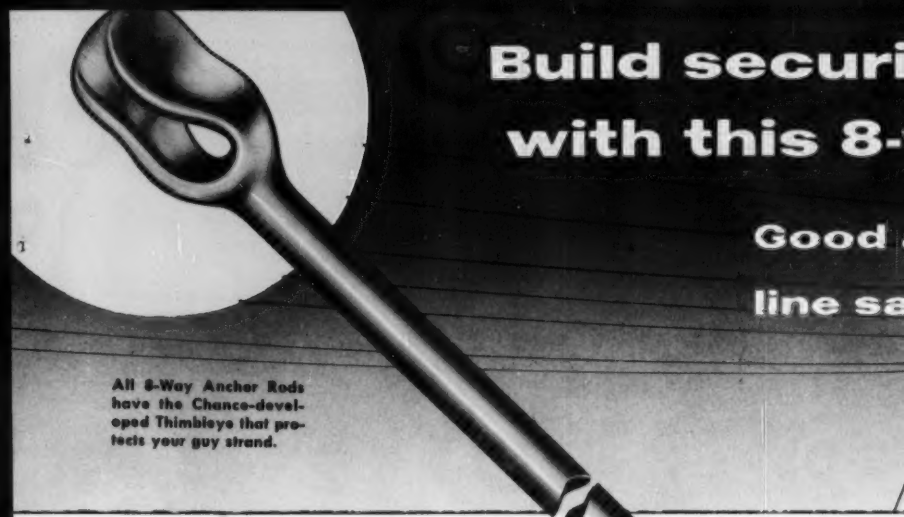


You can see the Chance 8-way slips right down in a hole no bigger'n the base plate. Now flip this flap to get a mole's eye view of how it expands below "sea" level.

Mike the Mole
Underground Observer

Build securi
with this 8-

Good
line sa



All 8-Way Anchor Rods have the Chance-developed Thimbleye that protects your guy strand.

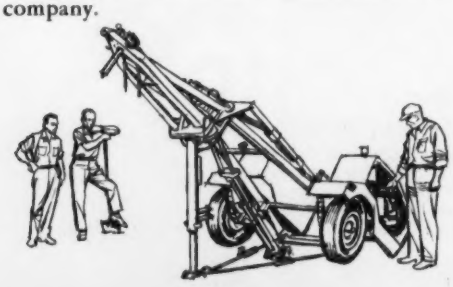
8-WAY EXPANDING ANCHORS FOR STRONGER GUYS · · · Only the Chance 8-Way Expanding Anchor, with its 8 rib reinforced blades, expands into solid earth *all the way around* to form a pyramid-like square.

Chance engineers, who have devoted their careers to developing and testing guying equipment, find that this design adds strength to expanding anchors. The pyramid enlarges the effective area of the anchor's holding power. Blades that expand side by side leave no wasted space between them, can be shorter—less apt to bend, and expand in a wide area of solid earth all around the hole.

That is why field test after field test made for power companies all over the country show that the Chance 8-way usually holds well beyond its rated load, and that is why it is on so many company standards.

Make the Chance 8-way *your* standard for the kind of T and D line guying you can install and forget.

CHANCE FIELD ASSISTANCE AIDS IN ANCHOR SELECTION · · · To assist you in anchor selection, to demonstrate the best installation methods and to test the results under specific soil conditions, the A. B. Chance Co. puts a nationwide team of anchoring experts at your service. These Regional Guying Specialists have the practical experience and technical knowledge to demonstrate proper anchoring to your field men. They have hydraulic testing equipment for on-location field tests to help determine what Chance anchors are right for your system. Call the nearest Chance Regional Manager in your area or ask the Chance Sales Representative to schedule a demonstration for your company.

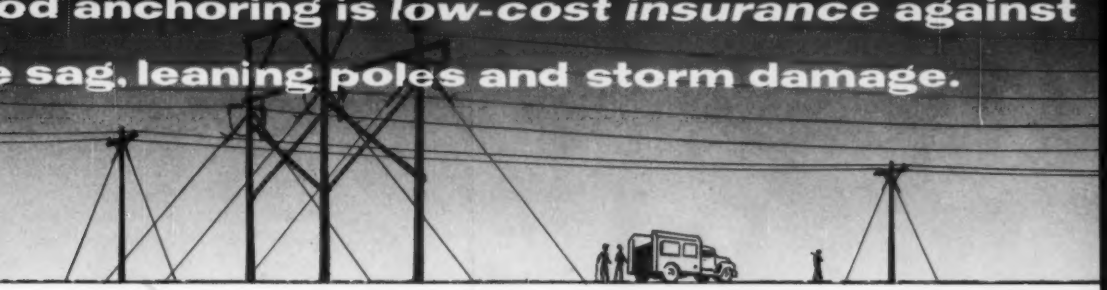


ABC INDUSTRIES

A·B·CHANCE
(A·B·Chance

urity into your T and D lines
8-way Expanding Anchor...

od anchoring is *low-cost insurance* against
e sag, leaning poles and storm damage.



Bottom view of the expanded 8-way shows how the eight blades expand to form a square—with no wasted space between blades. Nut retainer aids installation.

ES

ANCE CO., Centralia, Missouri
Chance Co. of Canada, Ltd., Toronto)

. . . and there are CHANCE ANCHORS for all other soil and guying conditions

CHANCE SCREW ANCHORS

for cost-cutting machine installation or hand installation

Many utilities which use screw anchors cut their installation time to a fraction by installing Chance Screw Anchors with hole boring equipment. They use the Chance "Blackfoot"* anchor because it is designed to screw down fast with little earth disturbance. This not only means less difficulty with installation equipment, but greater holding power and easier installation of the anchors that are to be screwed down by hand.

*The line crew's name for the line crew's choice.

- King-size thimbleye accomodates big turning bar or boring machine adapter.
- Smaller hub means less earth disturbed during installation. Adds to holding power.
- Blades are accurately "pitch-controlled" for fast-cutting, speedy installation.

CHANCE PLATE ANCHORS

for heavy transmission line guying

CHANCE CROSS-PLATE ANCHOR

When you're guying "big stuff" like transmission lines, you want anchors that will hold the load for the life of the lines.

The Chance Cross-Plate Anchor was designed specifically for installation in vertical machine bored holes to save time and money on transmission line construction. Costs 50% less than a log dead-man —holds more.

Chance Never-Creep Anchors pull entirely against solid, undisturbed earth to hold more load than any other type. Installed in angled hole —hand or machine bored.

Send for Bulletin 865: "How to Get Better Transmission Line Guying for Less."

CHANCE NEVER-CREEP ANCHOR

FOR ROCKY AREAS

Chance Expanding Rock Anchors wedge into solid rock. Chance Cone Anchors wedge against tamped rock.

FOR SWAMPLAND

Chance Swamp Screw Anchors screw down to any depth required for a firm grip.

FOR POLE KEYING

Chance Pole Keys expand at the butt of the pole for reinforcement in soft soil. Eliminate need for trench digging to install keys.

SEND FOR YOUR COPIES OF "ANCHORING"

Here is the most complete guide to better anchoring ever developed. It's full of how-to-do-it material to help you select the right anchor for every guying job—and get it installed properly.

A•B•CHANCE CO., Centralia, Missouri

(A•B•Chance Co. of Canada, Ltd., Toronto)

CA58-1

CG&E Makes Washday a "Bed of Roses"

Cincinnati Gas & Electric Co recently staged a "Make Washday a Bed of Roses" home laundry promotion that was a huge success. In addition to developing more than 20,000 good home laundry equipment prospects, the campaign went a long way toward bettering already good company relations with manufacturers, dealers, distributors and . . . the all important customer. Here's the way it worked.

Hundreds of blooming roses were grouped around a simulated "bed", a raised platform in the center of the CG&E lobby. This platform, surrounded by all name brand appliances, was the setting for the "Grow a Rose" Contest. Cincinnati papers ran CG&E ads containing coupons which, when filled in, became the prospect's ticket to enter the contest. Contestants presented their coupons and, using a sprinkling can shaped like a washer or dryer, tried "to make the roses "grow". An electric eye mechanism pushed the roses through the "ground" (see illustration) for the lucky winners. Prizes ranged from wash cloths to the grand prize of a new automatic washer and dryer. A total of 20,885 coupons were turned in during the contest.

Dealer traffic was built up in a novel but effective way. Contestants were informed that there would be an extra $100 in cash for the grand prize winner if his coupon was stamped by a local appliance dealer. Hundreds brought their coupons to dealers before coming into the CG&E lobby.

Other facets of the promotion that proved helpful included:

- A kickoff breakfast for dealers, distributors, manufacturers, the press, radio and TV.
- An extensive ad campaign in all three Cincy dailies plus suburban papers.
- A "Secret Shopper" promotion in which dealers were told that a "secret shopper" might call on them. If they said, "Let me show you how to make washday a bed of roses," their wives or sweethearts would receive a bouquet of roses.
- Election of a Rose Queen.
- Addresses by well-known personalities in Cincinnati gardening circles.
- Street music by a downtown Cincinnati insurance company organ featuring "Rose" songs.

LUCKY CONTESTANT Marcia Naberhaus tilts the sprinkling can in CG&E's 'Bed of Roses' home laundry promotion. Two roses come through the 'ground', and she wins a rose bush

Electric Water Heaters Get Big Promotional Boost

Detroit Edison has launched its largest local sales promotion ever built around electric water heaters —aimed at boosting 1958 sales in the area to 18,000 units, a 50% increase over 1957.

Newspaper ads totaling 1,735,216 lines are scheduled for the 135 dailies and weeklies in Detroit Ed's area. Most manufacturers are coordinating their ads with the promotion. TV commercials on three Detroit stations, and 3,888 radio spots on 12 area stations will be used. Appliance dealers and Detroit Edison customer offices will display and sell water heaters. Promotional aids for dealer stores and company offices include mobiles, brand-name banners and flashing animated signs.

All advertising will be integrated with the compaign's basic water heating theme: "Get it hot—get a lot . . . with a new electric water heater and Edison's Super Supply Plant!" Detroit Ed expects appliance dealers and plumbers to make the bulk of these sales.

AP&L Combines Campaigns

For the first time in its history, Arkansas Power & Light Co will conduct sales campaigns on two major appliances during the same periods. The campaigns will be a combined effort of manufacturers, distributors, dealers and AP&L to sell 5,800 ranges and 8,100 freezers during April, May and June, and September, October and November. Special newspaper sections, plus radio and TV will be used.

(*More Selling on page* 114)

Infrared Speeds Finishing of Concrete Columns

ROBERT G. SCOTT, Industrial Sales Engineer Sacramento Municipal Utility District, Sacramento, Calif.

Infrared lamps used to dry prestressed concrete columns right at the construction site have speeded up finishing and resulted in considerable savings in the "manufacture" of some 130 columns used in building the Sutter Junior High School in Sacramento, Calif. A 125-ft string of 40 lamps, spaced 3 ft apart, is mounted 2.5 ft from the columns. The lamps are rated at 250 and served by a 120-v line.

Columns 16 in. sq and 40 ft long are molded in a 125-ft, two-section steel and wood form. Reinforcing steel is placed in each form, then 12 steel cables are run the entire length and a stress of seven tons is put on each cable. Each form produces three columns. Concrete is poured and the infrared lamps quickly dry the exposed surface of the concrete. Steam is applied to "cure" the columns. They are then cut free, moved to location and erected. Each column weighs about 5 tons.

Printer Finds Electric Trucks Safer, More Economical

J. A. DEVEREUX, Industrial Power Representative, Baltimore Gas & Electric Co, Baltimore, Maryland

Electric fork lifts and hand trucks used for handling mountains of paper, ink, and other printing supplies are paying off in economy and general operating efficiency at Lord Baltimore Press, Baltimore, Md., one of the largest packaging-printing plants in the East. With the electrically-driven units, storing and handling highly volatile and inflammable fuels have been eliminated; noise, smoke and noxious exhaust fumes, characteristic of internal combustion engines, have been avoided. Maintenance is practically nil—with no carburetor or ignition to get out of adjustment, no oil changes, and no clutch troubles. An extra advantage in safety is the absence of slippery oil and grease drippings.

Small hand trucks powered by electric batteries provide the time-saving and labor-saving means of hauling

work in process through the various operating departments. In storage areas, for car loading and other purposes, electric fork lifts are used to tier palletized unit loads to ceiling height.

UNITS NUMBER 4 AND 5 OF

The DAYTON POWER and LIGHT COMPANY'S

Frank M. Tait STATION

DAYTON, OHIO

With the addition of unit 4 now nearing completion and unit 5 to follow in a few months — The Frank M. Tait Station will increase The Dayton Power and Light Company's system generating capacity from 510 megawatts to 770 megawatts.

The extension, carefully planned to match the architectural style of the original structure, contains two new 130 megawatt turbine generators, operating at 2400 psig with 1050°F initial temperature and 1000°F reheat temperature. These units will be supplied with steam from two of the first sub-critical monotube boilers installed in the United States.

Gilbert Associates, Inc., is proud to have been selected to participate in the engineering and design of this plant extension.

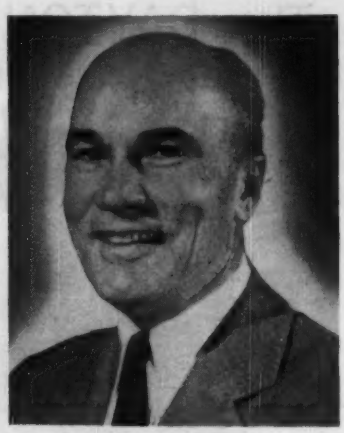
A SYMBOL OF GAI FOUNDED 1906 PROGRESS

GILBERT ASSOCIATES, INC.

ENGINEERS AND CONSULTANTS

READING, PENNSYLVANIA

Fleger Elected to Top Posts



Philip A. Fleger, chairman of the board and chief executive officer of Duquesne Light Co since 1950, has been elected to the additional position of president of the utility. He succeeds Pressly H. McCance, who retires from the presidency July 1.

Fleger's utility career began over 30 years ago when, fresh out of University of West Virginia's law school, he started with the Philadelphia Co system, to which Duquesne Light belonged. From his first job as law clerk he rose through the ranks and was named assistant general attorney in 1936. Since then he has served as general attorney (1939), vice president (1940), senior vice president (1942), and executive vice president (1946).

An active participant in industry affairs, he is a member of Edison Electric Institute's Advisory and Atomic Power Committees.

Iowa Public Service Ups Three Executives

Three officers of Iowa Public Service Co have risen to new executive positions. They are G. A. Neal, who becomes chairman of the board; C. R. Beddows, who was elected vice chairman and controller; and E. M. Raun, who was elevated to president of the utility.

Neal, formerly president, was elected to fill the vacancy created by the retirement of R. P. Stevens, who remains with IPS as a consultant.

During his 20-year term as president of IPS, Neal at one time was also chief executive of its parent company, the Sioux City Gas & Electric Co. Both have since merged. He is an engineering graduate of University of Kansas.

G. A. NEAL C. R. BEDDOWS E. M. RAUN

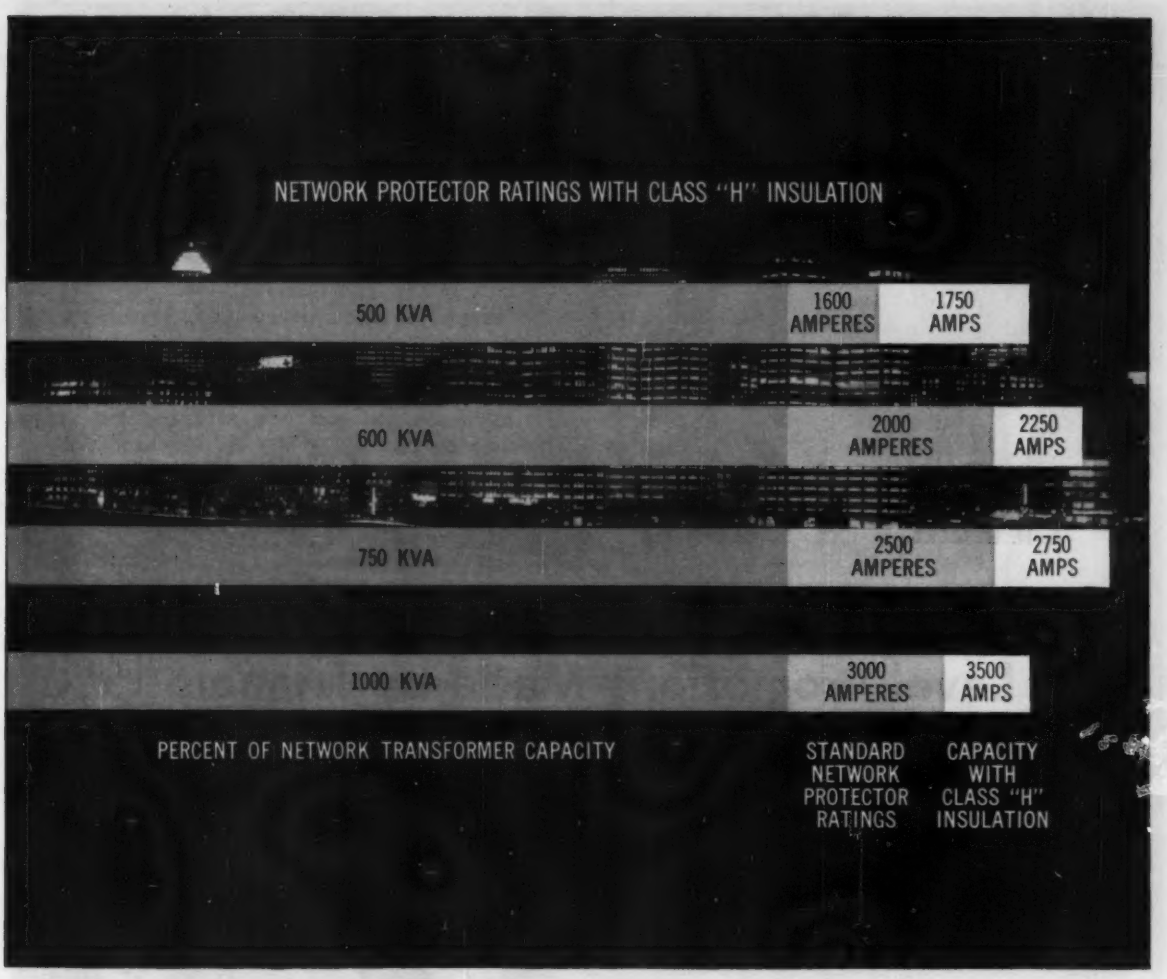
Beddows, who will now serve in the new capacity of vice chairman and controller, is former vice president and controller of the company.

Raun, vice president and general manager in recent years, will continue as general manager in his new position as president.

VP Doyle Gets Added Duties

Newly elected as general manager of Indiana & Michigan Electric Co is R. E. Doyle, Jr, vice president and assistant general manager since early in 1957. He moves into the position being vacated by C. V. Sorenson, who retired as general manager on June 1. Sorenson will continue as a vice president and director of the utility.

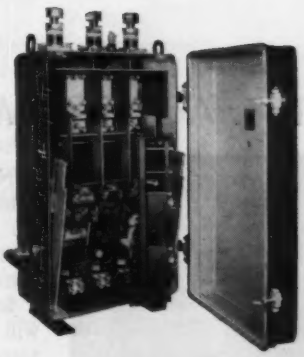
Doyle, who came to I&M last year, has 28 years of electric utility experience behind him. It started in 1930 when he joined Kentucky Power as a construction engineer. Then, after serving in positions of increasing responsibility, he was appointed as assistant general manager of that utility in 1946. He was promoted to general manager in 1948 and four years later was elected vice president. It was from the post of vice president-general manager of Kentucky Power that he joined I&M last year.



Standard Network Transformer Ratings vs Standard Protector Ratings at 216 Volts (protector ratings shown with and without Class "H" insulation).

Westinghouse network protectors give you more capacity

Class "H" insulation extends protector ratings... another "Plowback of Earnings" bonus



Now, another improvement from Westinghouse research to help smooth over network system growing pains. Westinghouse Network Protectors have always provided a margin between maximum current rating of protectors and full-load current rating of network transformers. The addition of Class "H" insulation to protector relays and current transformers allows continuous operation at higher currents within temperature limits of the insulation.

Other exclusive features of Westinghouse Protectors contribute to simplicity and flexibility in system planning and operation. They now provide *more* capacity in the same space and reduce maintenance time and costs to a record low. Design and expand with Westinghouse Protectors — for the ability to handle present loads and the flexibility for *future* needs. Why not get all the facts? Contact your Westinghouse representative now or write to: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania.

J-60946

YOU CAN BE SURE...IF IT'S

Westinghouse

Minnesota P&L Names Two to VP Positions

A. H. HERBERT H. CARPENTER

Minnesota Power & Light Co has promoted Axel H. Herbert to vice president and general manager and Hubbell Carpenter to vice president and chief engineer of the utility.

Herbert comes to his new position from that of vice president and assistant general manager of the utility. He now assumes part of the management duties formerly carried by Pres Clay C. Boswell, who had also been general manager. During his 32-year career with MP&L, he has also been a division manager and assistant to the general manager.

Carpenter, previous to his recent promotion, had served the utility as chief engineer for almost five years. Before joining the utility 14 years ago, he had worked on important engineering construction projects in Minnesota and throughout other western states.

Top Level Promotions Made by Triangle C&C

In top executive promotions, Triangle Conduit & Cable Co, Inc, has elevated John E. McAuliffe to chairman of the board, Joseph G. Slater to president, and Carl S. Menger to executive vice president.

McAuliffe, who has been serving as president of the New Brunswick, N. J., company, will continue as its chief executive officer.

Slater, who succeeds McAuliffe as president, is former executive vice president and treasurer.

Menger previously served as vice president-sales and continues to head sales in his new capacity.

In another promotion, Jack M. Slater was named treasurer and continues as assistant VP-industrial relations and assistant secretary.

McAULIFFE SLATER MENGER

Thor Advances McGuire

J. A. McGUIRE

New executive vice president of Thor Power Tool Co is John A. McGuire, former vice president of the company.

In his new position he will work largely with integrating the company's five subsidiary plants. For the past five years, as vice president, he has handled the company's labor policies and other executive functions.

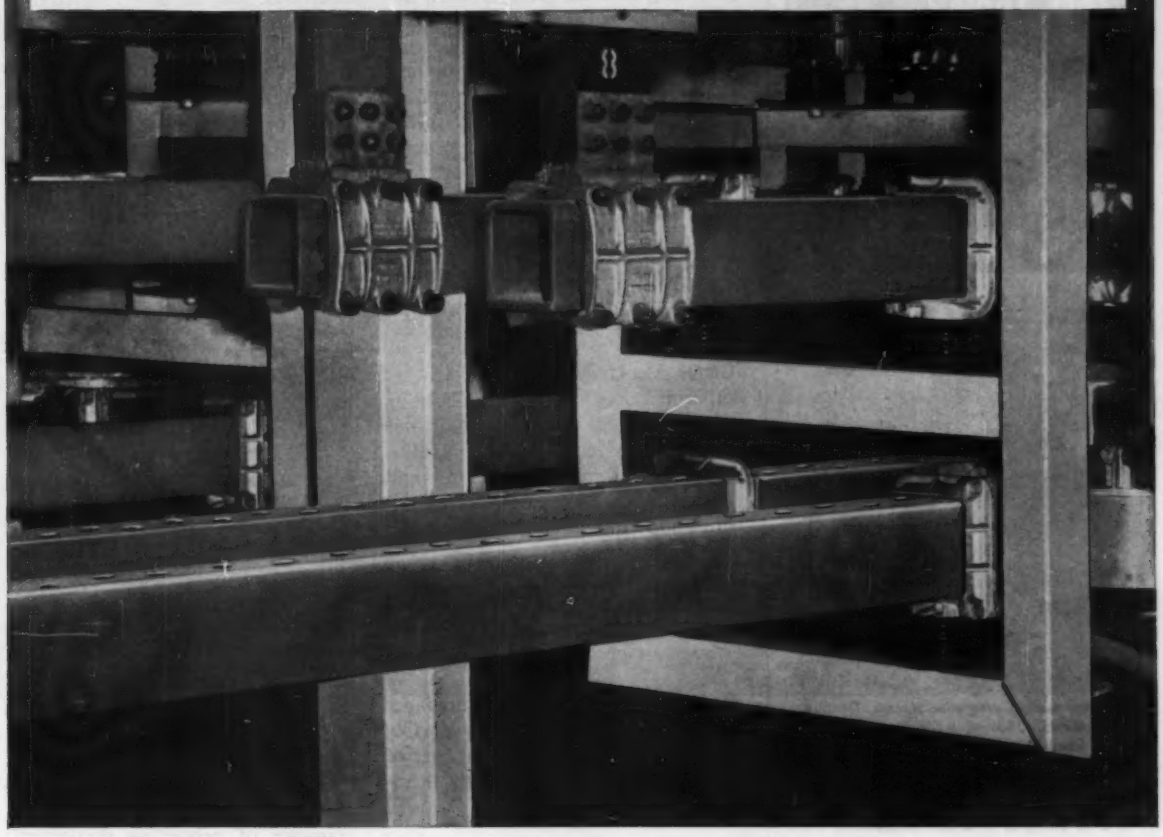
Puls Receives Promotion

Louis G. Puls was recently appointed chief designing engineer of the Bureau of Reclamation.

Previously assistant chief designing engineer, he now becomes the principal assistant of the assistant commission and chief engineer in all design matters. He is responsible for execution of all Bureau design activities in the 17 western states and Alaska.

L. G. PULS

Another 100% Chase Square Copper Tube Bus Installation . . . in a major steel plant



Over 200,000 lbs. of Chase® square copper tube Bus Conductor serve major tin plating line

Wherever—as in this tin plate line shown here—high amperage demands and safe current-handling capacities are a problem, there's a spot for Chase Copper Bus Conductor. Chase Square Copper Tube Bus Conductor has outstanding mechanical strength in all directions. Its flat surfaces can be tapped as easily as flat bars in making connections. Rounded corners eliminate excessive heating caused by skin effect. Ventilating holes can be provided in top and bottom surfaces, increasing current carrying capacity by about 20% for a given temperature rise.

Talk over your current-carrying needs—and Chase Square Ventilated or Unventilated Copper Tube Bus Conductor—with your own Electrical Contractor. Or call in your nearest Chase representative for consultation. You can reach him locally, or through Chase headquarters at Waterbury 20, Connecticut.

Chase® BRASS & COPPER CO.
WATERBURY 20, CONN.
Subsidiary of
Kennecott Copper Corporation

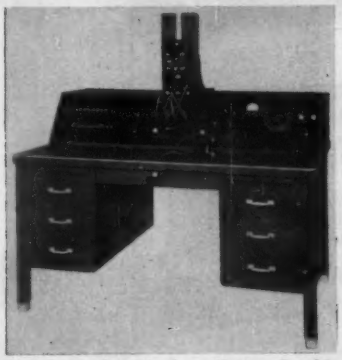
The Nation's Headquarters for Brass, Copper and Stainless Steel

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis Newark New Orleans New York (Maspeth, L. I.) Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

Want a
High Current
Test Table?

THE STATES COMPANY

Multi-Purpose
FORM FA TEST TABLE
150 Amperes



. . . for testing Watthour Meters, Graphic Instruments, Indicating Instruments, Relays, Small Transformers.

Handy and versatile, here's a table that will provide 0-150 ampere loading with 0-600 volts potential. Phase Displacement is 0 to unity, or 0 to 360 degrees.

Make sure your
TEST SWITCHES
have the exclusive
STATES features

- New Safety Grip Handle assures safer, easier gripping.
- No live parts extend beyond base.
- Maximum pressure at jaw contacts.
- Large Selection of pole arrangements.
- Nickel corrosion-resisting finish insures good contact, attractive appearance.

"SMK" TEST BLOCKS. Solid base type. Over 2,000 combinations of pole arrangements.

THE STATES COMPANY
19 New Park Avenue, Hartford, Conn.
I am interested. Please send further information on:
☐ TEST TABLES ☐ TEST BLOCKS
Name ..... Title.....
Name of Firm.....
Address .....
City ..... Zone.... State.....

PERSONAL BRIEFS

Harvey A. Wagner has been promoted from assistant manager of engineering to manager of system development for Detroit Edison Co. In the utility's overhead lines department, **Donald G. Emerson** was advanced to general superintendent and **M. Leslie Ernst** and **Paul Harner** have been named assistant general superintendents.

H. L. Pinkerton retires this month as commercial vice president of Public Service Co of New Mexico and will become a special assistant to the president.

Edgar M. Geddie is new assistant superintendent of lines for Carolina Power & Light Co . . . Utah Power & Light Co recently named **Julius M. Hoggard** to succeed **S. Dwight Packard,** retired, as Southern Division superintendent of lines and service.

Alabama Power Co has appointed **Jackson E. Crawford** as the new local manager at Marion.

P. W. Smith, Portsmouth manager of Virginia Electric & Power Co, has been named district manager of the Alleghany District with headquarters at Clifton Forge.

Shawinigan Water & Power Co has named **H. M. Finlayson** as an assistant vice president.

K. E. Fields has resigned as general manager of Atomic Energy Commission, as of July 1 . . . Stanford University's School of Engineering will have a new dean starting Sept. 1. He's **Joseph M. Pettit,** professor of electrical engineering and 1952 winner of the Institute of Radio Engineers achievement award.

Pacific Coast Electrical Association has elected as its new president **L. A. Hicks,** president of Hawaiian Electric Co.

In a recent appointment, Anaconda Co elevated **Ralph E. Schneider** to secretary and treasurer of the company to succeed **Earle Moran,** retired; **Thomas E. Tatem** and **Frank M. Byrnes** were each named assistant secretary and assistant treasurer.

The new position of director of purchasing of Anderson Electric Corp has been assumed by **George Yeckley.** The firm has named **Dave Russell** production control manager.

John A. McGuire has been elected executive vice president of Thor Power Tool Co . . . At Pittsburgh Reflector Co, **Charles S. Kernaghan** has been made general sales manager.

New vice president of RCA Semiconductor and Materials Division is **Dr Alan M. Glover . . . Carl V. Bradford** has been named director of RCA regional operations.

At Allis-Chalmers Manufacturing Co, **R. E. Persohn** has been named general manager of the Gadsden (Ala.) Works, and **N. W. Landis** was advanced to manager of the northeast region, Industries Group.

Line Material Industries recently appointed **Alvin B. Coyle** to director of market research and product distribution; **Albert R. Waehner** to director of transformer sales; **Dennis A. Manning** to manager of transformer sales and service; **George W. Cooper** to director of product management; **Carl E. Hoelz** to product manager of protective equipment; **William V. Swan** to product manage of power switching equipment; and **Clifford W. Peterson** to product manager of construction materials, porcelain, and outside materials.

Pennsylvania Transformer Division of McGraw-Edison Co recently named **W. Walter Renberg** as assistant sales manager . . . At Collins Radio Co, **W. W. Roodhouse** has risen to general sales manager and **R. C. Frost** to director of the International Division.

Recently elected as new officers of Mercoid Corp were **Hugh Courteol** as chairman of the board; **J. F. Chambliss,** president and treasurer; **W. L. Colterjohn,** vice president; **W. K. Stauffer,** vice president-eastern area; **R. F. Fisher,** vice president-western area; **W. E. Jones,** vice president-sales; **P. J. Provost,** vice president-industrial division; and **Paul Courteol,** secretary.

Over the entire 156-mile length of the new Indiana Toll Road, interchanges and service plazas are illuminated by lighting standards of Alcoa Aluminum. They were fabricated by The Union Metal Manufacturing Company, Canton, Ohio.

HERE'S WHY 1,700 LIGHTING STANDARDS ON THE INDIANA TOLL ROAD WILL NEVER NEED PAINTING

The answer, of course, is Alcoa® Aluminum! Lighting standards made of Alcoa alloys defy corrosion, both inside and outside. As a result, wall strength remains constant and poles keep their attractive appearance for life without any need for expensive, protective painting.

Savings mount in other directions, too. Aluminum standards weigh less than half as much as those of other materials, so they're less costly to ship, handle and erect. Yet there is no sacrifice of needed strength. Poles made of Alcoa Aluminum have withstood wind loading in excess of 100 mph. In fact, no wind damage to an aluminum lighting standard has ever been reported.

Add up the economies that start with faster, easier installation and increase year by year through elimination of painting. Then, if you plan to buy lighting standards, write us for the names of leading manufacturers who make them of Alcoa Aluminum. Aluminum Company of America, 1977-F Alcoa Building, Pittsburgh 19, Pa.

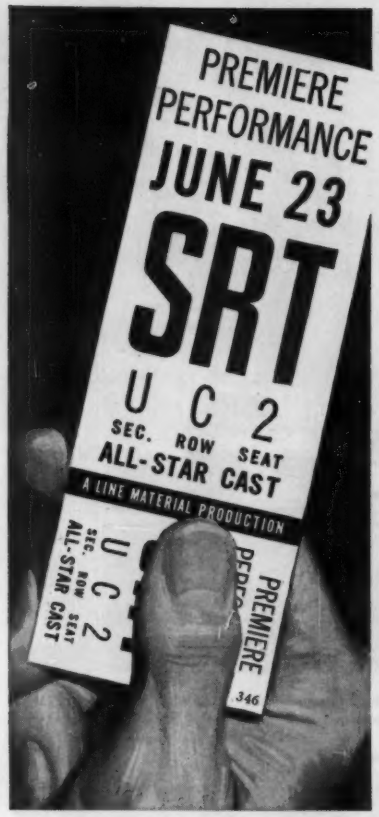
NEW LIGHTING STANDARDS FILM!

Ask to see Alcoa's interesting and informative film, *Alcoa Aluminum for Illumination*, on the history of street lighting and the fabrication of aluminum lighting standards. This movie, which has received the acclaim of lighting engineers from coast to coast, is now available for your viewing. For arrangements, write Aluminum Company of America, 1977-T Alcoa Building, Pittsburgh 19, Pa.

WE CHOSE ALCOA ALUMINUM MILL PRODUCTS
ALUMINUM COMPANY OF AMERICA

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
Exciting Adventure
ALTERNATE MONDAY EVENINGS



your future is in your hands

Right now you're holding the one *basic* reference in the electric power industry. Used regularly, it can help you, as it helps more than 26,000 others in all capacities to do a better job, get ahead faster. Get the ELECTRICAL WORLD habit.

SALES ASSIGNMENTS

COMPANY STAFFS

Allis-Chalmers Manufacturing Co recently appointed William D. Dineen as supervisor of distributor sales, electrical department, Norwood Works.

Collins Radio Co has named T. A. Farrell Texas regional sales manager in Dallas; G. M. Bergmann central regional sales manager in Cedar Rapids; and W. J. McKnight as manager of the New York office.

Four Wheel Drive Auto Co has announced these territorial assignments for four district sales managers in the southwestern area: Kenneth Jorgenson, New Mexico and all of Texas except the Gulf Coast; Keith Liesch, Oklahoma, Kansas, and western Missouri; Glen Pate, Tennessee, Alabama, Arkansas, and Mississippi; and Douglas Reed, Louisiana and the Gulf Coast of Texas. Liesch remains manager of the Duncan (Okla.) branch sales and service center.

General Electric Co's Apparatus Sales Division has promoted Raymond E. Wright as district industrial heating specialist for the central district . . . In the metallurgical products department, Thomas L. McSwine was named sales representative in the Atlantic district. He will cover New York City, Long Island, and the southern part of New York state.

Hotpoint Co recently appointed F. W. McDonald as manager of the Chicago district. This area was simultaneously enlarged to include the former Milwaukee territory. New sales manager for the Milwaukee-Appleton areas is E. W. Putz. In other appointments, A. P. Smith was made operating manager, Chicago district; and R. F. Eberle was appointed operating manager, Milwaukee.

McGraw-Edison Co's Pennsylvania Transformer Division has designated F. B. Saunders as head of the new southeastern district sales office in Atlanta, Ga. With Elwyn G. Riley, he will cover the states of Alabama, Florida, Georgia, South Carolina, Tennessee, and most of North Carolina.

Pittsburgh Standard Conduit Co has named two new sales representatives: Gerald L. Cronan, for eastern Pennsylvania and southern New Jersey, with offices in Philadelphia; and William T. Wright, for northern New Jersey, with headquarters in New York City.

Royal Electric Manufacturing Co, Inc, has designated George A. Wright as representative in Indiana and Kentucky.

Sylvania Electric Products, Inc, has made the following promotions in the Lighting Products Division: John J. Bahnak, to sales manager of the new Minneapolis district; George W. Ross, to assistant district sales manager in Chicago; and Horst C. Feige to engineering manager, eastern fluorescent fixtures sales, with offices in New York City.

Westinghouse Electric Corp's appliance sales component has named John W. Vogt manager of the Buffalo district. He is succeeded as manager of sales administration, Westinghouse Appliance Sales, Pittsburgh, by Leroy W. Newby.

REPRESENTATIVES

Four Wheel Drive Auto Co has designated the following as FWD utilities truck dealers: Utilities Equipment Co, Inc, Memphis, Tenn.; D. E. Crooker, Ontonagon, Mich.; Smith & Kerber, Broomall, Pa.; and Wisconsin Industrial Truck Co, Inc, Powers, Mich.

• Four years ago, this right-of-way in Kentucky was sprayed with Du Pont "Ammate" X weed and brush killer. Long-term control of brush, like this, results in lower maintenance cost on rights-of-way.

Control brush for years...without crop injury with one application of **Du Pont AMMATE® X**

WEED AND BRUSH KILLER

Du Pont "Ammate" X assures lower-cost, longer-term brush control, because when the original spray job is done well, only occasional spot sprays are required to keep brush under control for years. And you can use "Ammate" X on rights-of-way, even when they adjoin cropland planted to sensitive crops like cotton, soybeans, tobacco, tomatoes and peanuts. "Ammate" X is easy to use, and not hazardous to applicators, livestock or wildlife. As a foliage spray, "Ammate" X kills more kinds of brush and keeps it down longer than any other known herbicide.

For more information, write for free full-color booklet that shows the results of applications of "Ammate" X.

E. I. du Pont de Nemours & Co. (Inc.)
Grasselli Chemicals Dept., Rm. 4032-D
Wilmington 98, Delaware

On all chemicals follow label instructions and warnings carefully.

Here's What Users Say About AMMATE X

High Per Cent of Kill . . ."We adopted a systematic five-year program for our right-of-way spraying in 1953 after conducting experimental tests in the late forties and early fifties. We are well pleased with the high per cent of kill that we are now getting through the use of 'Ammate' X on the rights-of-way brush on our system, which is predominantly in a mountainous area. We fully recommend 'Ammate' X for the control of brush on all systems with comparable terrain."

W. L. WHITWORTH, *Manager*
Sequachee Valley Electric Cooperative, South Pittsburg, Tenn.

No Crop Injury . . ."Since we have been using 'Ammate' X for spraying brush along our electric lines, we have not had any injury occur to susceptible crops—cotton and soybeans—grown on farms adjacent to our lines."

FLOYD JONES, *Manager*
Gibson County Electric Membership Corp, Trenton, Tenn.

Reduce Line-Maintenance Expenses..."We have had 'Ammate' X applied to our Rural Electric right-of-way for three years. Since brush control is our main line-maintenance expense, we believe 'Ammate' X will considerably reduce this expense in future seasons."

H. C. GANGWER, *Manager*
Fort Louden Electric Cooperative, Madisonville, Tenn.

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING...*THROUGH CHEMISTRY*

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently-dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

FIRST AWARD for industrial sales negotiation is presented to Jay D. Aldrich, right, by Phil Alden at annual PEA Industrial Sales Conference in Skytop

Heating Potential Is Good

The Pennsylvania Electric Association's first Power Sales Award for the outstanding industrial sales negotiation of the year was presented to Jay D. Aldridge, Duquesne Light Co, at the annual PEA Industrial Sales Conference in Skytop, Pa. Aldridge received the award, a large bronze plaque and a check for $100, for selling "the electric way" to an asphalt plant owner, although the owner had already bought and received oil heating equipment for his plant. A total of 17 entries were received from salesmen in the PEA member companies.

Taking a look at sales prospects in the near future, Harry Restofski, West Penn Power Co vice president, said the biggest potential growth markets are in electric heat for melting, heat treating, induction and general process heating; modernization of manufacturing machinery and processes; air conditioning; and lighting at levels above 100 ft-c. Other new potential loads are promised by ultrasonics, large-scale use of oxygen in steel making, quartz lamp heating, and heat pumps.

Current markets might be jeopardized in the future, Restofski said, by use of absorption air conditioning in large commercial buildings; radiation treatment of foods, with loss of refrigeration and food processing loads; and air drying paints which do not require baking ovens.

In 1970, industrial power salesmen will need broader background, with some knowledge of general and nuclear physics, plus chemical, mechanical, and metallurgical engineering. He will think as an industrial engineer instead of a utility engineer, he declared.

Electric heat competes most favorably with gas for applications with temperatures below 500 F, where gas temperatures are hard to control, and above 1,700 F, where gas efficiency is poorest, according to West Penn's Carl Hartwig. In selling electric heat, collateral advantages should be stressed and cost comparisons made only when desirable.

R. D. Ketner, General Electric Co, suggested that utilities should have individual sales plans for important customers, industries, and applications, each geared to a timetable.

Winding up the two-day conference, R. C. Swartz, Pennsylvania Power & Light Co commercial vice president, said salesmen must not take it for granted that customers have unlimited wants and needs that can be tapped at will.

Termite colony under glass at new research laboratory of United States Steel.

We have termites—so you won't

Termites attack untreated wood—pressure-creosoted wood repels termite attack.

Solid black indicates heavy incidence of termites; dark gray, heavy to moderate; and light gray, slight to moderate.

There's a colony of termites working for United States Steel in our new research laboratory. One of our scientists located them in an old stump near one of our test plots in Mississippi. Now their habits are being studied to find out what makes creosote such an effective protection against these destructive insects.

Termites are found in every state in the union, with heavy infestations as far north as Wisconsin and Massachusetts (see map). They eat and digest ordinary untreated wood and soon attack wood that has been merely dipped or coated. But the deep penetration of pressure creosoting offers lasting protection against termites and other wood destroying organisms. Pressure-creosoted poles and timbers have averaged 35 years of life in many localities.

Pressure creosoting should be looked upon as low-cost insurance. Its advantages and economies are thoroughly proved. For more information on pressure treatment and USS Creosote—the quality preservative—write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa., or call the nearest United States Steel Chemical Sales Office. *USS is a registered trademark*

Chemical Sales Offices in Pittsburgh, New York, Chicago, Salt Lake City and Fairfield, Alabama

USS Creosote

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: "OPPORTUNITIES" :EQUIPMENT :USED OR RESALE

DISPLAYED RATE: ——RATES—— **UNDISPLAYED RATE:**

EMPLOYMENT OPPORTUNITIES: $22.67 per inch. Subject to Agency Commission.
EQUIPMENT & BUSINESS OPPORTUNITIES: $16.85 per inch for all advertising appearing on other than a contract basis. Not subject to Agency Commission.
AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.
EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

$1.80 a line, minimum 3 lines. To figure advance payment count 6 average words as a line.
PROPOSALS, $1.80 a line an insertion.
BOX NUMBERS count as one line additional to undisplayed ads.
DISCOUNT OF 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

Send New Advertisements to Classified Advertising Div. of Electrical World, P. O. Box 12, N. Y. 36, N. Y.

New and Used Equipment Available for
POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION
Send for new list to
EBASCO SERVICES INCORPORATED
APPARATUS EXCHANGE — Two Rector St., New York 6, N. Y.

LARGE POWER EQUIPMENT
Prompt Stock Shipment
RENUBILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS
DO YOU GET OUR STOCK LIST?
BELYEA COMPANY, INC.
51 Howell St. Jersey City, N. J.
OL-3-3334

MOTORS—GENERATORS
TRANSFORMERS
NEW—REBUILT
World's Largest Inventory
ELECTRIC EQUIPMENT CO.
Phone Station Collect GL 3-6783
P. O. Box 51, Rochester, N. Y.

Rate Engineers Wanted By REA

Rural Electrification Administration has openings in Washington, D. C. for electrical retail and wholesale rate engineers. Retail rate work includes estimating cost of service, developing rate schedules for various classes of service and preparing contracts. Wholesale rate work includes estimating production and transmission costs, analyzing and developing rates and schedules and preparing contracts. Starting annual salary up to $8,645. Selections made under Federal Civil Service competitive regulations. Apply Henry C. Starns, Chief, Personnel Division, Section A-1, Rural Electrification Administration, U. S. Department of Agriculture, Washington 25, D. C.

SALESMAN

Electrical supply distributor, national scope, has attractive opening for one experienced in selling wire cable and distribution equipment. Salary and incentive commission. Apply with complete resume to:
SW-8122, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

Don't forget the

BOX NUMBER

When answering the classified advertisements in this magazine don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

ADDRESS BOX NO. REPLIES TO: Box No. Classified Adv. Div. of this publication. Send to office nearest you.
NEW YORK 36: P. O. Box 12
CHICAGO 11: 520 N. Michigan Ave.
SAN FRANCISCO 4: 68 Post St.

POSITION VACANT

Electrical engineer as distribution transformer designer to be employed in California in connection with transformer factory. Must have graduated from recognized engineering school or have equivalent in experience as transformer designer. P-8164, Electrical World.

EMPLOYMENT SERVICE

Salaried Personnel $5,000-$30,000. This nationwide service successful since 1927 finds openings in your fields. Sells your abilities; arranges contacts. Present position protected. Write for details—Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

SELLING OPPORTUNITY OFFERED

Wanted: Salesman already calling on electrical industry wishing to supplement present income with little sales efforts. Field contacts augmented by present advertising program. Most territories still available. Write to SW-7992, Electrical World.

PERIODICAL

A.I.E.E. Transactions wanted to buy for cash. Back volumes and Back Sets. Also other technical and scientific Periodicals. E. W. Ashley, 27 East 21, N. Y. 10 N. Y.

Your inquiry will have Special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertisers wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.

Job Ahead for REA

(*Continued from page 58*)

REA had dropped them.

The association almost immediately ran head-on into a fight with REA Administrator Slattery over plans to establish its own mutual insurance companies. NRECA's two companies—incorporated in Maryland as the Rural Mutual Fire Insurance Co and the Rural Mutual Casualty Insurance Co — would have furnished coverage for workmen's compensation, employee's liability, automobile liability, hospitalization, and property damage or loss. Both companies died on the vine when Slattery refused to permit the co-ops to invest their surplus funds in such a venture, and NRECA eventually turned its group insurance programs over to an established mutual company.

Ellis' insurance plans had involved the capitalizing of the two companies with member co-ops' surplus funds in excess of funds on which the government had a lien. He understood that Slattery had agreed to the plan, and was planning to submit the plan to the NRECA directors the same day that Slattery issued his "stop-look-listen" order.

Slattery said, "under certain circumstances," REA would have "no proper interest in an insurance program of this kind." He questioned whether "enterprises almost wholly financed by the federal government, should, in the early days of their operation, and before maximum debt services have been matured, engage in such extensive insurance activities . . ."

The ensuing bitterness between Slattery and the association led eventually to Slattery's resignation.

Ellis had been in Washington politics four years. He became NRECA's first executive manager, when his term in the House of Representatives expired in January, 1943, and after his primary defeat by McClellan. He sees no end to the need for federal financing of rural co-ops, as they heavy up existing lines, add service connections and built G&T facilities to meet new loads. This year the association urged Congress to vote $359 million for new REA loans.

PROFESSIONAL SERVICES

AMERICAN AIR SURVEYS, INC.

- Aerial Topographic Maps & Photos
- Plan & Profile for Transmission Lines
- Aerial Stereo-photos for Planning
- Topographic Maps for Reservoir Studies
- Coal Stockpile Volumes by Aerial Method

907 Penn Avenue — Pittsburgh 22, Pa.

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
30 State Street, Albany, N. Y.

BLACK & VEATCH

Consulting Engineers

Electricity—Water—Sewage—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates

1500 Meadow Lake Parkway — Kansas City 14, Mo.

BROOKLYN ENGINEERING CORP.

Utilities Erectors & Consultants

Baltimore 30, Md.

Power Plant equipment erection, mechanical and electrical construction from manufacturers and engineers drawings. Supervision by general power engineering staff for heat cycle coordination. Improvements—Modifications—etc.

THEODORE D. BROSS LINE CONSTRUCTION CORP.

Steel Tower & Wood Transmission Lines

Distribution & Maintenance

175 Endfield St. — Hartford, Conn.

BURNS and ROE, Inc.

Engineering and Design • Reports • Surveys
Construction • Electric, Steam, Hydro Plants
Transmission • Distribution • Aeronautical Facilities • Research and Development • Nuclear, Chemical, and Industrial Plants

160 West Broadway • New York 13, N. Y.

COMMONWEALTH SERVICES INC. | ASSOCIATES INC.

Management and Business Consultants
300 Park Ave.
New York 22, N. Y.

Consulting and Design Engineers
209 E. Washington
Jackson, Michigan

DAY & ZIMMERMANN, INC.

Engineers

Design—Construction
Transmission—Distribution Lines
Reports—Valuations—Rates

New York — PHILADELPHIA — Chicago

DOBLE ENGINEERING COMPANY

Electrical Insulation Engineers

Field Testing and Maintenance of High Tension Insulation, Special Problems in Electrical Communications

Office and Laboratory: Doble Park
Box 344, Belmont 78, Mass. (6 miles from Boston)
Branch Office: 30 N. Wacker Dr., Chicago, Ill.

ELECTRICAL TESTING LABORATORIES, INC.

Electrical, Electronic, Environmental, Photometric and Chemical Laboratories. Testing, Research, Inspection and Certification.

2 East End Ave. — New York 21, N. Y.

FORD, BACON & DAVIS

Engineers

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York • Chicago • Los Angeles

GILBERT ASSOCIATES, INC.

Engineers and Consultants

DESIGN
SUPERVISION OF CONSTRUCTION
BUSINESS AND ECONOMIC RESEARCH

Reading, Pa. — New York, N. Y.

HARZA ENGINEERING CO.

Consulting Engineers

Calvin V. Davis — E. Montford Fucik
Richard D. Harza
Hydroelectric Plants and Dams
Transmission Lines
Flood Control, Irrigation
River Basin Development

400 West Madison Street — Chicago 6

HOOSIER ENGINEERING COMPANY

Erection and Maintenance of Electrical Transmission and Distribution Lines

1384 Holly Avenue, Columbus, Ohio

JACKSON & MORELAND, INC.

Engineers and Consultants

Design and Supervision of Construction
Reports—Examinations—Appraisals
Machine Design—Technical Publications

Boston — New York

JENSEN, BOWEN & FARRELL

Engineers

Appraisals—Investigations—Depreciation Studies—Cost Trends—Reports
for Rate Cases, Security Issues, Regulatory and Accounting, Requirements
Original Cost and Continuing Property Record Determination
Ann Arbor, Michigan

PETER F. LOFTUS CORPORATION

Design and Consulting Engineers

Electrical • Mechanical • Structural
Civil • Nuclear • Architectural

First National Bank Building
Pittsburgh 22, Pennsylvania

CHAS. T. MAIN, INC.

Engineers

Electric, Steam and Hydraulic Projects,
Investigations, Reports, Appraisals
Design and Construction Supervision

Boston, Mass. — Charlotte, N. C.

PIONEER SERVICE & ENGINEERING CO.

Consulting and Design Engineers. . Purchasing Specialists in Financing Accounting and other Operations

231 So. La Salle St. — Chicago 4

SANDERSON & PORTER ENGINEERS

Design
Construction

New York — New York

SARGENT & LUNDY

Engineers

140 South Dearborn St.

Chicago, Ill.

SVERDRUP & PARCEL, INC.

Engineers - Architects

Design, Construction Supervision
Steam and Hydro Power Plants
Power Systems - Industrial Plants
Studies - Reports

St. Louis — San Francisco — Washington

TIPPETT & GEE

Consulting Engineers

Mechanical • Electrical • Thermodynamic
Structural Design • Studies • Supervision
Power Stations • Transmission • Distribution
Industrial Plants • Process

1333 North Second Street — Abilene, Texas

F. A. TUCKER, INC.

Contractors—Engineers

specialize in
Distribution - Transmission - Telephone lines - Maintenance - Roads - Bridges Dams

Main Office — 28½ Center Street, Rutland, Vt.
Branch Office — Little Rock Road, Charlotte, N. C.

UTILITIES LINE CONSTRUCTION COMPANY, INC.

Construction and Maintenance

Transmission - Distribution
Electric and Telephone Lines
Consultants

505 York Road — Jenkintown, Pa.

VERNON GRAPHICS, INC. | VERNON GRAPHICS OF PA. INC.

CONSULTING AND SERVICING UTILITIES ON MAPS, RECORDS AND FIELD INVENTORY

Mount Vernon, N. Y. MO 4-7117 | Norristown, Pa. Broadway 9-3090

WALTER von TRESCKOW

FINANCIAL
AND ECONOMIC CONSULTANTS

400 E. 52nd Street — New York 22, N. Y.

THE J. G. WHITE ENGINEERING CORPORATION

Design • Construction • Reports • Appraisals

80 Broad Street, New York 4

The Meetings Calendar

JUNE

The American Society of Mechanical Engineers—Semi-Annual Meeting, Statler Hotel, Detroit, Michigan, June 15-19.

Michigan Electric Association—Annual Convention, Grand Hotel, Macinac Island, Mich., June 22-25.

American Institute of Electrical Engineers—Summer General Meeting, Buffalo, N. Y., June 22-27.

The American Society of Testing Materials—Annual Meeting, Statler Hotel, Boston, Mass., June 22-27.

JULY

National Housewares and Home Appliance Manufacturers Exhibits—Auditorium, Atlantic City, N. J., July 7-11.

Colorado Farm Power Council—Electric House Heating School, co-sponsored by Colorado State University Agricultural Engineering Department, Colorado State University, Fort Collins, Colo., July 10-11.

• **Oklahoma Utilities Association**—Accounting Section Conference, Ardmore Hotel, Ardmore, Okla., July 18.

Western Summer Radio-Television & Appliance Market—Western Merchandise Mart, San Francisco, Calif., July 21-25.

AUGUST

Southeastern Electric Exchange Public Utility Executive Course—Georgia Institute of Technology, Atlanta, Ga., Aug. 4-29.

American Institute of Electrical Engineers—Special Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers, Hotel Statler, Los Angeles, Aug. 6-8; Pacific General Meeting, Sacramento, Calif., Aug. 19-22.

The Institute of Radio Engineers—Conference on Electronic Standards and Measurements, NBS Boulder Laboratories, Boulder, Colo., Aug. 13-15.

• **Illuminating Engineering Society**—National Technical Conference, Royal York Hotel, Toronto, Canada, Aug. 17-22.

SEPTEMBER

• **Edison Electric Institute**—Accounting Division and Section Organization Meeting, sponsored jointly with AGA, Netherland Hilton Hotel, Cincinnati, Ohio, Sept. 8-9; Meter and Service Committee, Driscoll Hotel, Corpus Christi, Texas, Sept. 22-24.

• **Maryland Utilities Association**—34th Fall Conference, The Cavalier-Sir Walter Raleigh Hotels, Virginia Beach, Va., Sept. 12-13.

• **Rocky Mountain Electrical League**—Annual Fall Convention, Jackson Lake Lodge, Moran, Wyo., Sept. 14-17.

• **American Institute of Electrical Engineers**—Power Industry Computer Application Conference, King Edward Hotel, Toronto, Canada, Sept. 15-17.

• **World Power Conference**—Sixth International Congress on Large Dams, Statler Hotel, New York City, Sept. 15-20.

• **Northwest Electric Light & Power Association**—51st Annual Meeting, Sun Valley Lodge, Sun Valley, Idaho, Sept. 17-19.

• **Public Utilities Association of the Virginias**—40th Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 18-21.

• Additions this week.

MORE BIG DATES FOR '58

Edison Electric Institute — Industrial Relations Committee Round Table Conference, Hotel Drake, Chicago, Ill., Sept. 29-Oct. 1.

National Electrical Manufacturers Association—Annual Meeting, Atlantic City, Nov. 10-14.

National Association of Railroad and Utilities Commissioners—Annual Convention, Westward Ho Hotel, Phoenix, Ariz., Nov. 17-20.

Advertising Index

Allis-Chalmers Mfg. Co. ..... 2nd Cover
8, 9, 28
Aluminum Co. of America 35, 36
37, 38, 121
American Chemical Paint Co. 97
American Creosoting Corp. 7

Babcock & Wilcox Co. 12, 13
Blackburn Corp., Jasper 45

Chance Co., A. B. 109, 110, 111, 112
Chase Brass & Copper Co. 119
Circle Wire & Cable Corp. 83
Continental-Diamond Fibre, Sub. Budd Co. 14

Delta-Star Electric Division, H. K. Porter Company, Inc. 77
Directory of Engineers 127
du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Dept. 99
Grasselli Chemicals Dept. 123
Polychemicals Dept. 46

Eastern Specialty Co. 84
Electric Controller & Mfg. Div. Square D Co. 16
Electric Service Works, Delta-Star Electric Division H. K. Porter Company Inc. 77
Electrical Utilities Co. 6
Electro-Motive Div., General Motors Corp. 40, 41, 42, 43
Engineers, Directory of 127

Federal Pacific Electric Co. ..... 3rd Cover

G&W Electric Specialty Co. 104
General Cable Corp. 18
General Electric Co.
Apparatus Dept. 73, 84
Gilbert Associates, Inc. 115

Hathaway Instrument Div., Hamilton Watch Co. 85

I-T-E Circuit Breaker Co., Switchgear Div. 30
Indiana Steel & Wire Co., Inc. 124
International Business Machines Corp. 39

Kuhlman Electric Co ..... 4th Cover

Lapp Insulator Co,, Inc. 44
Line Material Industries 47, 48
49, 50, 51, 52, 82, 122

Meter Devices Co. 122
Mineraliac Electric Co. 84
Minnesota Mining & Mfg. Co. 33
Moloney Electric Co. 86, 87

Ohio Brass Co. 23, 24, 25, 26
Okonite Company 4

Penn-Union Electric Corp. 31
Pennsylvania Transformer Div., McGraw-Edison Co. 75
Phelps Dodge Copper Products, Corp. 78, 79
Pioneer Service & Engineering Co. 98
Preformed Line Products Co. 15

RT&E Corp. 101
Radio Corp. of America 10, 11
Rome Cable Corp. 102, 103

S&C Electric Co. 17
Sangamo Electric Co. 27
Searchlight Section 126
Southern States Equipment Corp. 29
States Company 120

United States Steel Corp., Coal Chemical Sales Div. 125
United States Industrial Chemicals Co. 32

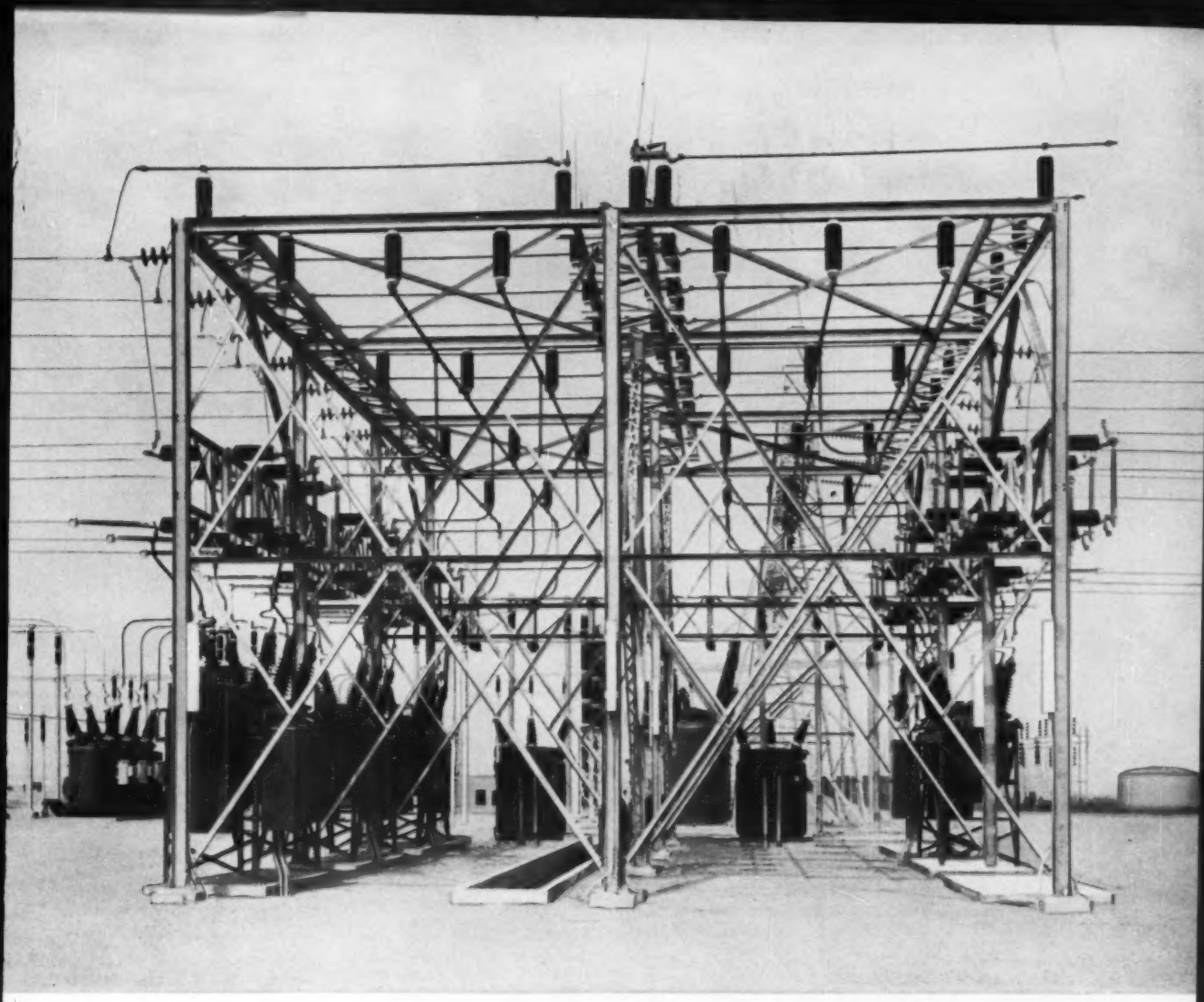
Wagner Electric Corp. 81
Westinghouse Electric Corp. 34, 89
90, 91, 92, 93, 94, 95, 96, 117

PROFESSIONAL SERVICES 127

CLASSIFIED ADVERTISING
F. J. Eberle, Business Mgr.

EMPLOYMENT OPPORTUNITIES 126

EQUIPMENT
(Used or Surplus New)
For Sale 126



SINGLE-SOURCE SUBSTATION PACKAGE

assures totally-integrated, economical installations

Speeding installation...saving you time and trouble...assuring top quality construction throughout – Federal Pacific stands ready to meet *all* your switchgear requirements in a single operation. The advantage: one order, one equipment manufacturer, unified control.

From initial engineering service to the completed installation–one plan guides the entire project to simplify purchasing, provide more accurate cost control and eliminate unexpected "hidden costs". And more important, when you buy the complete package from Federal Pacific you are assured a completely integrated installation. Each component is engineered to insure trouble-free, smoothly integrated operation.

With more than 50 years of experience in this field...with installations throughout the world...with a steady flow of repeat orders indicating satisfied acceptance–Federal Pacific is equipped to meet all your switchgear needs from beginning to end. Federal Pacific Electric Co., 50 Paris Street, Newark 1, N. J.

FEDERAL FPE PACIFIC

Better Products to Control Electricity

Linemen like this Feature...

KUHLMAN transformers are WHITE inside

Look, Bill. All Kuhlman pole type transformers have white interiors like this.

You can see every component clear down to the bottom of the tank. Sure makes inspection easy.

Right. It'll be a snap to change a connection or a tap, even when you're on the pole and using a flashlight.

Well, this one passes my inspection. Let's hoist her up.

White interiors—a Kuhlman exclusive—make periodic inspection faster and surer by helping the lineman see clearly all the way to the bottom. This much-appreciated feature doesn't add a penny to the cost, however. Kuhlman's dual-flow paint system sprays exterior gray and interior white simultaneously, preparing the tank for the bake oven in one operation.

Look into a light, *white* Kuhlman transformer. You'll see the advantage of white interiors right away!

KUHLMAN ELECTRIC COMPANY

General Offices: Birmingham, Michigan

BAY CITY, MICHIGAN • CRYSTAL SPRINGS, MISSISSIPPI • SALINAS, CALIFORNIA